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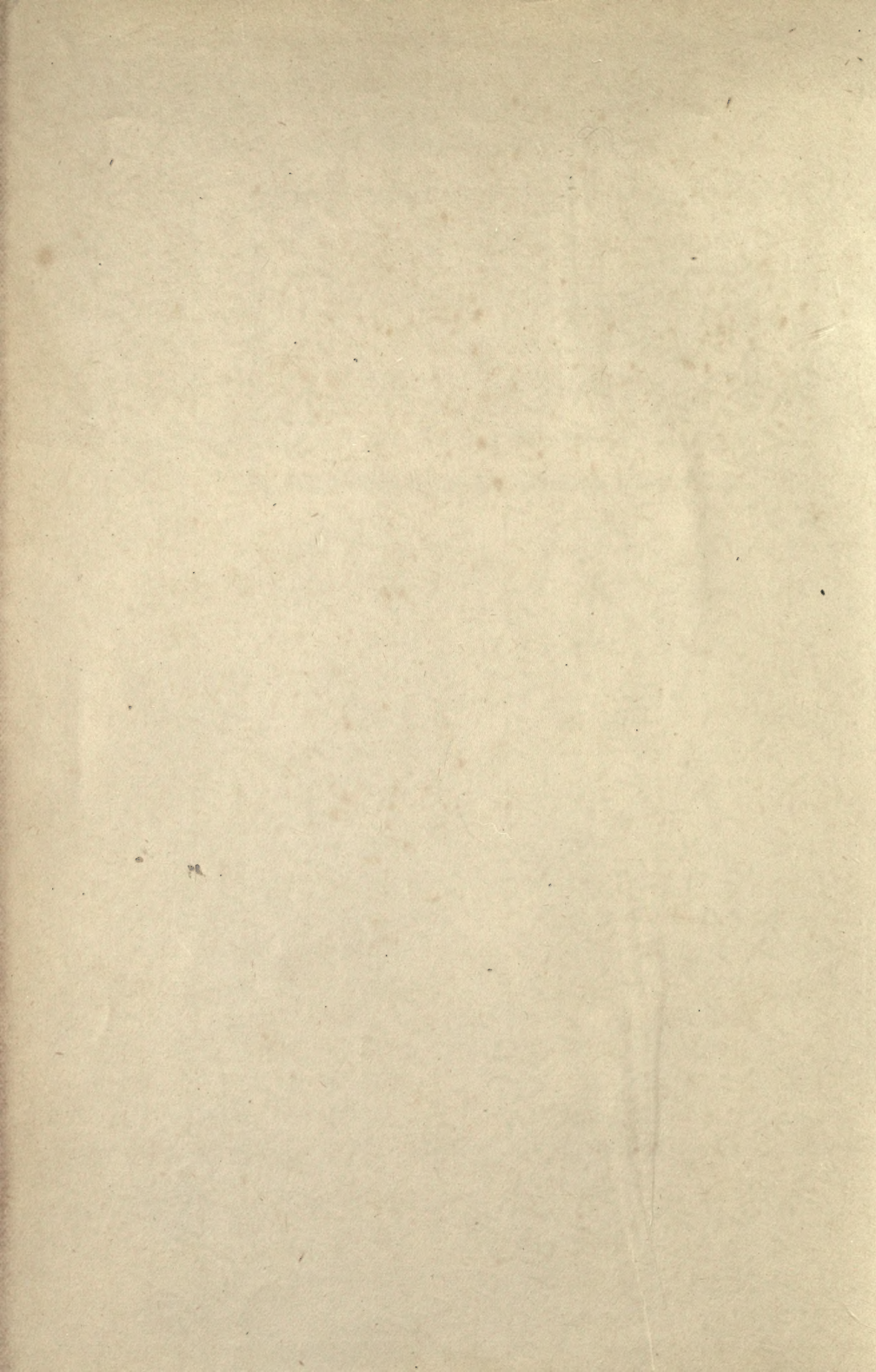
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EARTH, SEA AND SKY

OR

MARVELS OF THE UNIVERSE

BEING

A FULL AND GRAPHIC DESCRIPTION OF ALL THAT IS WONDERFUL, IN
EVERY CONTINENT OF THE GLOBE, IN THE WORLD OF
WATERS AND THE STARRY HEAVENS.

CONTAINING

Thrilling Adventures on Land and Sea

RENOWNED DISCOVERIES OF THE WORLD'S GREATEST EXPLORERS
IN ALL AGES, AND REMARKABLE PHENOMENA IN
EVERY REALM OF NATURE.

EMBRACING

The Striking Physical Features of the Earth

THE PECULIAR CHARACTERISTICS OF THE HUMAN RACE, OF ANIMALS, BIRDS,
INSECTS, ETC., INCLUDING A VIVID DESCRIPTION OF THE

Atlantic, Pacific and Indian Oceans

AND OF THE POLAR SEAS, THE MONSTERS OF THE DEEP, BEAUTIFUL SEA-
SHELLS AND PLANTS, SINGULAR FISHES AND DWELLERS IN THE
WORLD OF WATERS, REMARKABLE OCEAN CURRENTS, ETC.

TOGETHER WITH THE

Amazing Phenomena of the Solar and Starry Systems

THE WHOLE COMPRISING A

Vast Treasury of all that is Marvelous and Wonderful
IN THE EARTH, SEA, AIR, AND SKIES.

BY

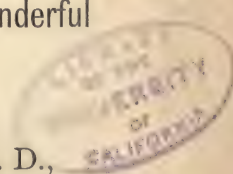
HENRY DAVENPORT NORTHROP, D. D.,

Author of "Marvelous Wonders of the Whole World," etc., etc.

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THE J. DEWING COMPANY,

SAN FRANCISCO, CAL.



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ANIMALS OF THE TROPICS.





PREFACE.

In the preparation of this work, the object has been to furnish a volume which would in itself form a complete library of knowledge and entertainment. Whatever is worth knowing, whatever is of absorbing interest respecting the history, manners and customs of strange and curious people; respecting the singular animals of pre-historic times and the marvels of natural history, including the curiosities and unique creations of the animal kingdom, will here be found.

A natural division has been made according to the three great divisions of the universe, EARTH, SEA, AND SKY, and the result is a combination of Three Books in one Volume.

In the first part of the work the reader is conducted through the countries and climes of the whole world. He is even led back to periods before the advent of man. The ancient world with its vast forests, remarkable deluges, strange animals and gigantic upheavals rises before him. He sees immense quadrupeds and birds, more monstrous than any of the imaginary creatures of old mythology.

Coming down to a later period the reader visits the famous countries of the globe, climbs the mountain ranges of Asia, stands on "Alps piled on Alps," witnesses burning volcanoes, extinct craters, terrible avalanches and landslides, moving glaciers, earthquakes that swallow cities with thousands of their inhabitants, the brilliant aurora painted on the northern sky, and the fatal ravages of cyclones, and tornadoes. The marvelous relics that are discovered under the microscope, together with living creatures are computed by tens of thousands to the square inch.

The various Races of Men, their customs, forms of government and religious rites, human sacrifices and savage wars are fully described. What exploits of heroism, and bravery in the face of danger and death it has cost to explore these realms and reveal their amazing secrets! As may be seen, the book abounds in strange adventures, startling situations, interesting anecdotes, descriptions of curious animals and the most fascinating revelations in natural history.

In the second part of the volume the reader is made a voyager over the world of waters and an explorer of its wonderful depths. He sees here the vast variety of inhabitants in the briny deep, comprising innumerable species of living creatures, from the coral insect, building its singular islands, up to the huge sea-serpent, that astounding monster and object of terror.

He is shown in this World's Aquarium the lowest forms of life, fantastic shrubs, brilliant sponges, bell-shaped jelly-fishes, the hairy medusæ, the glutinous hag, the curious star-fish, the electric torpedo, the fishing frog, creatures that wear armor, the savage cuttle-fish, the pearly nautilus, the flying-fish, the voracious shark, the singing-fish and other marvelous creatures whose multitude is as the sands of the sea.

The perils of the deep, celebrated voyages and miraculous escapes, the most terrible shipwrecks, the dangers of whaling cruises and the loss of hundreds of lives, the notable feats of the diving bell and the deep sea-dredgings which have revealed miracles of creation in the cavernous depths of the ocean, the venturesome exploits of pearl-fishing: these and myriad other things are here placed before the reader in glowing descriptions, with elegant illustrations, the beauty and charm of which are apparent on every page.

The reader finds that the volume does not end here, and that he has more worlds to conquer. He has yet to survey the starry universe and stand in awe before the abysses of infinite space, and be dazzled by the armies of light that sweep over the celestial plains. He gazes at Arcturus, Orion and the Pleiades; at clusters of *nebulæ* which are found to comprise countless orbs; at gigantic Suns, so distant that they are called fixed stars, arrayed, as the astronomer's telescope assures us, in all the gorgeous colors of the rainbow; at Constellations which must have been old when man was young, and at fleets of myriad orbs sailing in the upper deep, led by the Lords and High Admirals of Creation. He beholds showers of falling meteors, and the amazing flight of comets, "those emblazoned flags of Deity."

Old astrology is likewise scanned, and ancient Superstitions and Grotesque Beliefs are described, together with Eclipses, Coronas, Auroras and all Celestial Phenomena.

HENRY DAVENPORT NORTHROP.

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BOOK I.

THE EARTH.

CHAPTER I.

MARVELS OF THE ANTEDILUVIAN WORLD.

Curious Old Legends and Superstitions—A Chinese Quarryman—A Scandinavian God with his Sledge-Hammer—Strange things Seen by a Sybil—The Crust of the Earth a Museum of Singular Relics—Footprints and Skeletons of Gigantic Birds and Four-Footed Animals—Enormous Sizes and Uncouth Forms—Extinct Species of Animal Life—An Immense Fish-Lizzard—Extraordinary Marine Reptile—A Wing-Fingered Monster—A Freak of Nature—A Fossil Reptile Sixty Feet Long—The Scaly Hylæosaurus—Discovery of the Mammoth—An Island of Bones—The Huge Dinotherium—A Bulky Creature that could neither Walk, Leap nor Climb—Natural History Printed on Leaves of Stone—Marks of Raindrops, Trees and Birds on Rocks—Fossil Remains of Myriads of Minute Beings—Layers of Various Kinds of Shells Forming Marble of Great Beauty—Wonders of a Drop of Water Under the Microscope.



THE scenes of creation astonish us, whether uplifting our look we gaze at the brilliant heavens, or cast our eyes upon the tiniest creatures of this lower realm. Immensity is everywhere. It stands revealed in the azure dome of heaven, where glows a perfect dust of stars, and in the living atom which hides from us the marvels of its organization. The ideas of the ancients respecting the birth of the world, and the origin of its wonderful forms of life, appear to us to be very singular. We find curious old traditions and legends, stories of mighty gods and enormous giants, who had something to do with the work of creation. There were strange fancies, too, concerning the shape of the earth, the boundaries of its lands and seas, the foundation on which it was built, and the movements of the heavenly bodies.

The Grecian picture of the creation, as we see it engraved on the shield of that famous warrior, Achilles, represents the earth as a flattened disk, surrounded everywhere, and in a circular form, by the sea, or rather by the river of ocean which defines the limits of the known world. Above this terrestrial disk the solid sky is outspread like a dome; a dome supported by two massive pillars, which rest on the god Atlas. A similar absurdity prevails among several ancient peoples. The Scandinavians balance the

earth on nine posts. The Brahmins figure it as propped up on four elephants. But on what foundation do these nine posts and four elephants repose? What Anak of a god can support on his brawny shoulders the burden of the terrestrial mass? Without pausing over these questions, let us complete our outline of the Grecian picture: The solid vault of the heavens is traversed by the stars in chariots of silver, impelled by the



PAN-KOU-CHEE, THE CREATOR—(FROM AN OLD CHINESE PAINTING).

rapid clouds. When the sun bursts upon human eyes, he emerges from the sea on the side of the east; in the evening, he re-plunges, on the west, into the same great river. During the night, borne in a golden car, he re-ascends, beneath the earth, the pathway of the eternal ocean. There—that is to say, below the earth—spreads another vault, corresponding

in its curvature to that of the sky : the vault of Tartarus—the shadowy realm of the Titians, those rebellious and vanquished angels of the Pagan mythology. Sombre and silent, Tartarus is shrouded in everlasting night.

Chinese Legend of the Creation.

When we cast a glance upon creation, we are astonished at its vastness, and we see that none of our fictions attain the sublimity of its proportions. For instance, the Chinese account of creation represents the first organizer of chaos under the form of a feeble old man, enervated and tottering, called Pan-Kou-Ché, surrounded by confused masses of rock, and holding a chisel in one hand and a hammer in the other. He toils painfully at his work, with chisel and hammer, and, covered with perspiration, carves out the crust of the globe, at the same time that he clears a path through a wilderness of rocky masses. One shudders at the relative feebleness of the workman to the immensity of the task. Well nigh lost amidst enormous masses of shattered stone, which surround him on every side and encumber the picture, he appears to be a real pigmy executing a herculean task.

On the other hand, the people of the North, looking upon their land so often devastated by floods, thought that some god in his anger had broken up the surface of it, and gathered the ruins into heaps. But to the children of Scandinavia this deity was not a trembling used-up old man ; they required a divinity endowed with their own savage energy. In their eyes it was the god of tempests ; the redoubtable and gigantic Thor, who, armed with a blacksmith's hammer, and suspended over the abyss, with mighty blows broke up the crust of the earth, and fashioned out the rocks and mountains with the splinters. Here we see already an advance upon the feeble old Pan-Kou-Ché ; strength is substituted for the weakness of old age. Thor shows like a revolted giant, raging and shattering everything that falls within his reach.

To us such images appear very puerile. Instead of these old men and giants laboriously occupied in hammering out the globe, we only trace everywhere the invisible hand of the Creator. In one place, with a delicacy which passes all conception, it animates the insect with the breath of life, in another, expanding itself to vast dimensions, it reins the worlds scattered through space, and convulses or annihilates them. It is at such times that, in the midst of its throes, our globe cleaves its mountains and opens its abysses ; and upon each of its gigantic ruins, as upon each grain of sand, the philosopher finds written a grand page of natural wonders.

In the Scandinavian mythology we discover some pictures of the great events which then took place in the earth and in the heavens. The description paints the ravages of the volcanic eruptions and of the waves of a wild and untamed ocean. The inspired sybil relates that at this time the sun did not rise where it now does, and that the East was invaded by polar ices. I remember, says the sybil, nine worlds and nine heavens.



THOR, THE GIANT-GOD OF THE SCANDINAVIANS, RECONSTRUCTING THE GLOBE.

Before the sons of the gods raised the globes, the sun shone in the South. In the East is seated the old woman in the forest of iron (the polar ices). The sun is covered with clouds, the earth sinks in the sea, the shining stars disappear from the heavens, clouds of smoke envelop the all-nourishing tree, lofty flames mount even to heaven; the sea rears itself violently towards the skies and passes over the lands. Neither earth

nor sun exist any longer; the air is overcome by glittering streams. The sybil for the second time sees the earth, covered with verdure, rise from the sea.

Thus the people of antiquity had their superstitions and their fabulous legends, but these were never so widely diffused as they became in the middle ages, a period of simple ignorance and ardent faith. At that time, as M. Figuiet says in his excellent work on this epoch, all classes of the people, and even a great part of the nobility, the magistracy, and the clergy, believed in magic. Learned men vied with each other in collecting all the fables of their forefathers and recording them in their works. They found monsters in every kingdom of nature, and equally in the depths of the sea as in the heavens. They appeared to think men were compelled to draw on their imaginations for the marvelous, the absurdity of which amuses us at the present day, for we have learned that in the great realms of nature scenes are presented which are more extraordinary and thrilling than any fictions of ancient times. Yet the most eminent men of the middle ages, who could discuss all branches of human knowledge of that day with perfect clearness, seemed to be struck with blindness as soon as the question turned upon monsters. One well-known naturalist describes with minute precision all the localities in the Alps, all the animals to be found there, and every flower that blooms in their valleys. Every object is drawn with extraordinary skill; there is so much delicacy in his engravings that the humblest moss may be recognized. But along with these faithful representations of nature, we find frightful aerial monsters; winged dragons which swarm in the obscure windings of roads, and stop the alarmed traveller. The perusal of the work of this author might well have sufficed to prevent our credulous ancestors from venturing into the gorges of the Alps or searching into their dark caverns!

The Earth Born of Fire and Water.

Another celebrated work represents sirens, monks, and men-at-arms of the sea, all covered with scales, and as fresh as if they had just withdrawn from the gulfs of Neptune. Kircher, who was also a well-known writer, pictures frightful dragons which guard the riches of the earth, and which must be vanquished before obtaining possession of them.

When learned men began to occupy themselves with the formation of the earth, they became divided into two very clearly defined opposite parties: the Plutonists, who attributed the crust of the globe exclusively to fire; and the Neptunists, who, on the contrary, derived everything from the action of water. The truth is that fire and water have had

their share by turns. One part of the terrestrial crust is the result of ignition, the other that of the deposit from water. It is evident that the globe is only a sun crusted over and partially extinguished, the hardened surface of which hides the great interior furnace from view.

The globe on fire, and launched into space, necessarily gave off heat, and when after a long succession of ages it had sufficiently cooled



COMBAT WITH KIRCHER'S WINGED DRAGON.

its surface became solidified, and constituted the primitive crust. When this cooling process had made sufficient progress, the vapors from the earth, an immense atmosphere of which enveloped the globe, became condensed and for ages descended upon the earth in torrents of rain. Gleams of lightning and incessant peals of thunder accompanied these imposing

scenes of the birth of our globe, of which our imagination will never yield us more than an imperfect image.

Origin of the First Seas.

At the same time that, in the course of ages, the crust of the earth increased in thickness, the cooling down, by contracting the globe, forced its envelope to yield and break. These convulsions produced the mountains which now diversify its surface. Whilst the crust of the earth was yet thin, a slight effort of the central heat sufficed to rupture it, but this only produced insignificant elevations. When this crust had acquired greater thickness, its rupture, inasmuch as it required much greater force, was only effected by means of the most violent movements; it was then that the Cordilleras rose into the clouds. The upheaval of each mountain chain was necessarily accompanied by violent commotions in the depths of the sea, and thence came those grand scenes of deluges mentioned in the traditions of all nations. These great upliftings, of which fifteen have been proven by geological science, terminated by the rising of the chain of the Andes, the result of an immense rent extending almost from pole to pole. Then the two Americas were lifted above the ocean, and assumed their present shape. Thus fire and water successively remodelled the surface of the globe. It is to be remarked that the crust of the earth in breaking follows a fixed direction. All the great mountain chains have been developed from the north to the south, as the Andes and Ural, or from west to east, as in the Atlas chain.

Amazing Destruction of Animal Life.

It is evident that each period had its peculiar organic forms, and that the species of animals of one epoch neither lived before nor after this epoch. Humboldt himself, the most illustrious philosopher of modern times, embraces this opinion without any qualification. Each upheaval, he says, of these mountain chains of which we can determine the relative antiquity, has been signalized by the destruction of ancient species and the appearance of new forms of life. Numerous groups of animals and plants have had their beginning and their end, and creative intervention must have manifested itself at the appearance of each of them. The earth is only an immense cemetery where each generation acquires life at the expense of that which has just expired; the particles of our corpses form new materials for the beings which follow us.

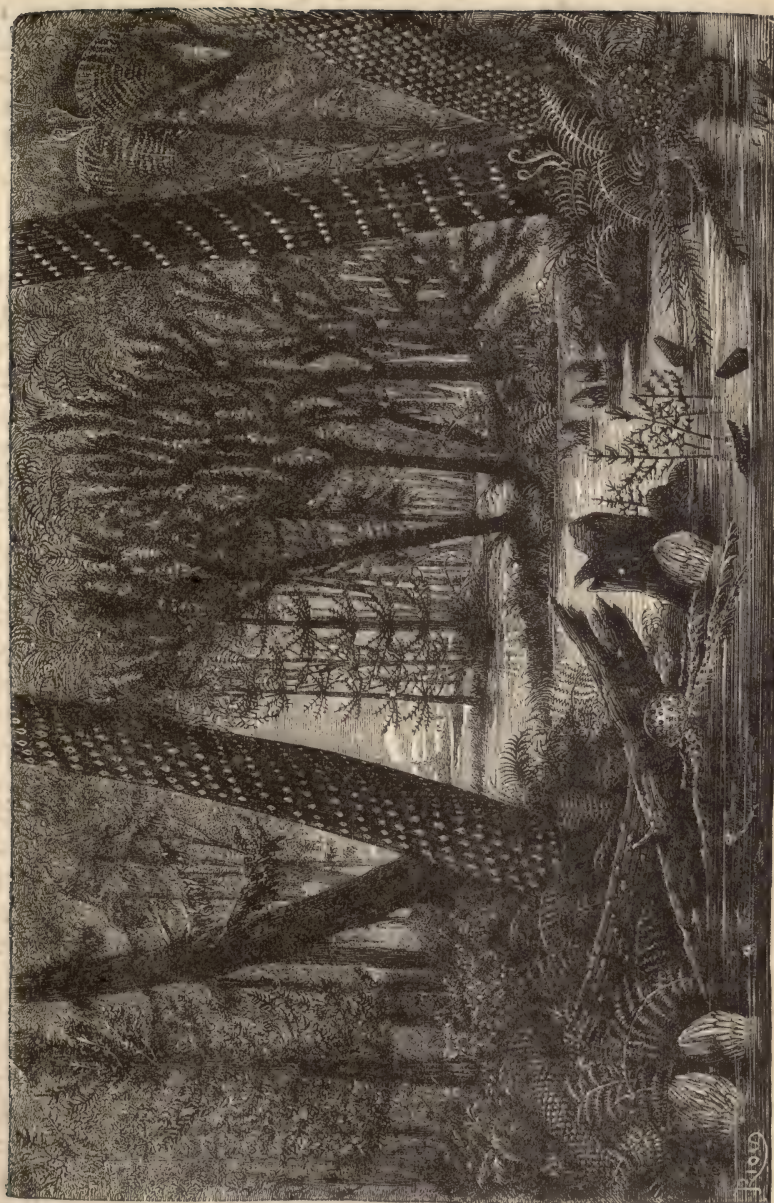
The first layers of the earth that cooled down became covered with a luxuriant vegetation, the remains of which now constitute our coal-beds—antediluvian forests, which the genius of man extracts from the depths of the earth, to serve the wants of industry and his own dwellings.

During this period the whole surface of the globe was covered with strange and dense forests, where proudly reigned a host of plants and trees, the representatives of which at the present day play but a very humble part. Here were palms and bamboos, there gigantic moss-like plants, which bore straight stems towering to a height of eighty to a hundred feet. Then came immense growths, the stems of which remind one of a reptile's scaly armor. Lastly came trees of the family of our pines and firs, their boughs laden with fruit.

Gigantic Growths of Vegetation.

These vast primeval forests, which the course of ages was to annihilate, sprang up on a heated and marshy soil, which surrounded the lofty trees with thick compact masses of aquatic plants, intended to act a great part in the formation of coal. The luxuriant vegetation of the coal period was certainly favored by the enormous heat which the scarcely-chilled terrestrial crust still preserved, as also by the dampness of the atmosphere, and very probably by the great abundance of carbonic acid which it then contained. Although a thick and magnificent mantle of foliage covered the globe, everything wore a strange, gloomy aspect. Everywhere rose gigantic rushes and ferns, drawing up an exuberance of life from the fertile and virgin soil. The latter in their aspect resembled palms, and the least breath of wind waved their crowns of finely-cut leaves like flexible plumes of feathers. A sky, ever sombre and veiled, oppressed with heavy clouds the domes of these forests: a wan and dubious light scarcely made visible the dark and naked trunks, shedding on all sides a shadowy and indescribable hue of horror. This rich covering of vegetation, which extended from pole to pole, was sad and utterly silent, as well as strangely monotonous. Not a single flower enlivened the foliage, not one edible fruit loaded its branches. The echoes remained absolutely mute, and the branches without a sign of life, for no air-breathing animal had as yet appeared amid these dismal scenes of the ancient world!

One might say, in fact, that there was then no animal life to be seen, for amid so many remains of the coral flora, which geologists have so admirably reconstructed, they have only met with a few rare vestiges of one small reptile. This great contrast between the richness of the vegetable and penury of the animal kingdom is explained by the great quantity of carbonic acid at that time mixed with the atmosphere, which, though particularly favorable to the life of plants, must have been fatal to all animals endowed with active respiration. But though the atmosphere was poisonous, the seas, on the contrary, uniting to-



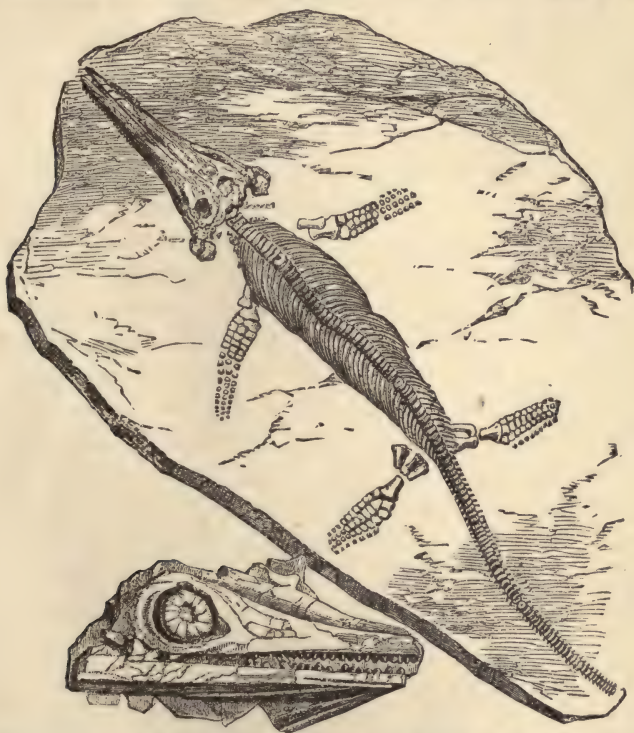
THE PRIMEVAL FOREST FROM WHICH OUR COAL-BEDS WERE FORMED.

gether all conditions most favorable to life, were peopled with shelled molluscs and fish. After having lent life to the primitive ages of the globe, these strange forests completely disappeared in the lapse of ages, and they have now become almost impossible to recognize, owing to the transformations they have undergone in nature's immense subterranean store-houses. There can, however, be no doubt about the matter. It is clearly the remains of these antique forests of our planet that constitute the coal of the present time. Science, carrying its torch even into the dark regions whence these remains proceeded, has discovered all the constituent parts. Amid the black and gleaming masses of the coal strata abundant impressions have been found of the plants which produced our vast beds of coal.

Discovery of an Antediluvian Monster.

In the year 1814, Sir Everard Home published an account of some large and very remarkable bones found in a rock, thirty or forty feet above the sea level, on the English coast. The remains examined were incomplete, and the nature and habits of the animal to which they belonged baffled all inquiry, until the discovery of more perfect skeletons unfolded a race of water reptiles, which received the name of *ichthyosaurus*, or fish-lizard. This strange creature ranging from twenty to more than thirty feet in length, of which ten species are enumerated, had the snout of a porpoise, the head of a lizard, teeth of a crocodile, the vertebrae of a fish, and the paddles of a whale; thus presenting in itself a combination of mechanical contrivances which are now found distributed among three distinct classes of the animal kingdom. Persons to whom this subject may now be presented for the first time, will receive with much surprise, perhaps almost with incredulity, such statements as are here advanced. It must be admitted that they at first seem much more like the dreams of fiction and romance than the sober results of calm and deliberate investigation; but to those who will examine the evidence of facts upon which our conclusions rest, there can remain no more reasonable doubt of the former existence of these strange and curious creatures, in the times and places we assign to them, than is felt by the antiquarian, who, finding the catacombs of Egypt stored with the mummies of men, and apes, and crocodiles, concludes them to be the remains of animals and reptiles, that have formed part of an ancient population on the banks of the Nile. The teeth of the lizard-fish, in some instances amounting to two hundred and ten, and the length of the jaws to more than six feet, qualified it for preying upon weaker creations; and the half-digested remains of fishes and reptiles, found within the skeletons, indicate the precise nature of its food.

A single paddle of the four with which the animal was furnished sometimes contains more than a hundred bones, giving it great elasticity and power, and enabling it to proceed at a rapid rate through the water. The eye was enormously large, its cavity, in one species, being fourteen inches in its longest direction. The eye also had a peculiar construction, to make it operate both like a telescope and a microscope, so that the animal could descry its prey by night as well as day, and at great depths in the water. This fish-like lizard in some degree answers to the words of Milton :



REMARKABLE SKELETON OF AN IMMENSE FISH-LIZZARD.

With head uplift above the waves, and eyes
That sparkling blazed, his other parts besides,
Prone on the flood, extended long and large,
Lay floating many a rood.

The lizard-fish was an air-breathing, cold-blooded, and carnivorous inhabitant of the ocean, probably haunting principally its creeks and bays, fitted by its formidable jaws and teeth, its rapid motion and power of vision, to be the scourge and tyrant of the existing seas of its era, keeping the multiplication of the species of other animals within proper limits.

Though essentially marine, and admirably adapted by its organization to cut the waves, certain peculiarities of structure have induced the opinion that the forward paddles might be subservient to locomotion not only in the water, but on land. Professor Owen thinks that the ichthyosauri, like the existing crocodiles, may have come ashore to sleep, or resorted thither to deposit their eggs. The remains of these animals occur in great abundance on the English coast where the cliffs appear to be inexhaustible quarries of them.

A Strange Marine Reptile.

In the same strata in which the remains of the ichthyosaurus are found, another marine reptile appears, which received its name of plesiosaurus, signifying akin to the lizard, from its more closely resembling animals of this genus than fishes, especially in the character of the skeleton. A similar remarkable combination of forms appears in this animal to that which distinguishes its preceding relative—the head of a lizard, the teeth of a crocodile, a neck resembling the body of a serpent, the trunk and tail of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale. Such are the strange combinations of form and structure in the plesiosaurus, a genus, the remains of which, after interment for thousands of years amidst the wreck of millions of extinct inhabitants of the ancient earth, are at length recalled to light by the researches of the geologist, and submitted to our examination in nearly as perfect a state as the bones of species that are now existing upon the earth. Its most striking feature is the great length of the neck, which has from thirty to forty vertebræ, or bone joints, a larger number than in any known animal, those of living reptiles varying from three to six, and those of birds from nine to twenty-three. It has been therefore correctly compared to a serpent, threaded through the body of a turtle. That it was aquatic, is evident from the form of its paddles; that it was marine is almost equally so, from the remains with which it is universally associated; that it may have occasionally visited the shore, the resemblance of its extremities to those of the turtle may lead us to conjecture; its motion, however, must have been very awkward on land; its long neck must have impeded its progress through the water, presenting a striking contrast to the organization of the lizard-fish, which so admirably fitted it for that purpose. May it not therefore be concluded (since in addition to these circumstances, its respiration must have required frequent access to air) that it swam upon or near the surface, arching back its long neck like the swan, and occasionally darting it down at the fish which happened to float within its reach? It may perhaps have lurked in shoal water along the coast, concealed among the sea-weed, and raising its nostrils to the surface from a considerable depth,



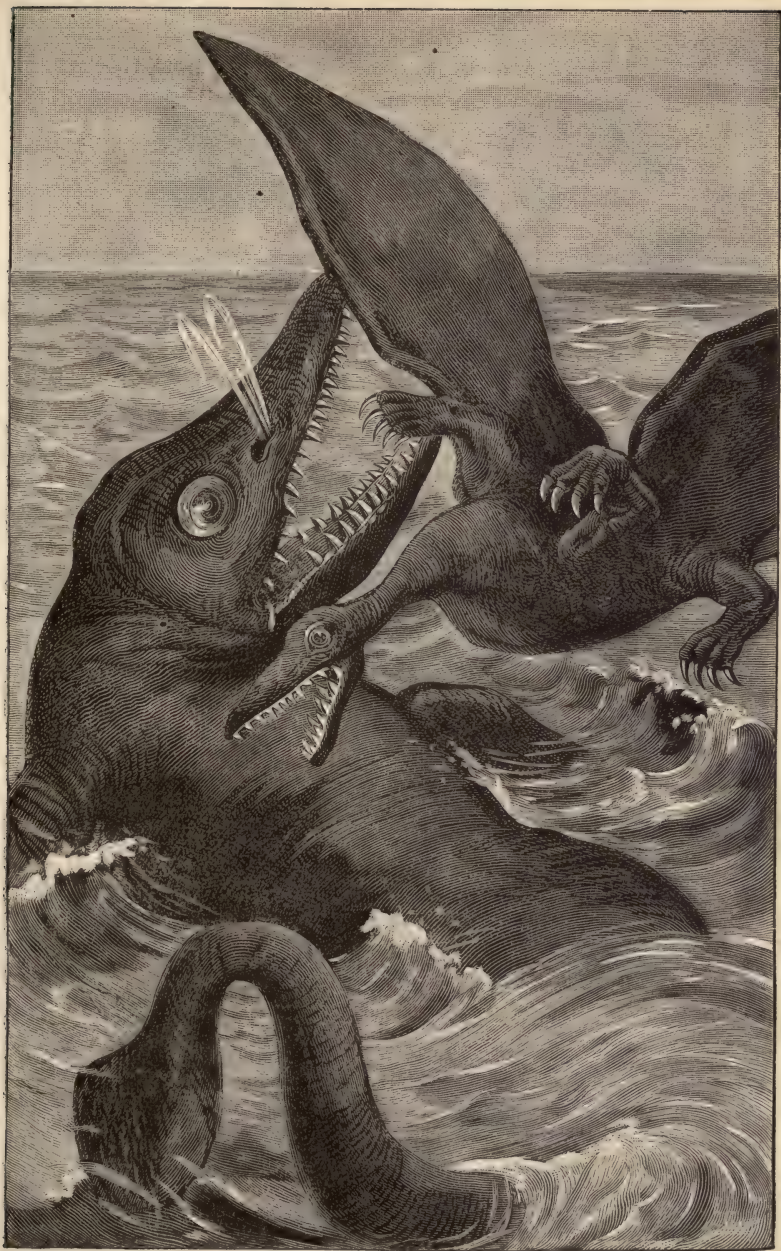
ENORMOUS EXTINCT ANIMALS—THE ICHTHYOSAURUS AND PLESIOSAURUS.

may have found a secure retreat from the assaults of dangerous enemies; while the length and flexibility of its neck may have compensated for the want of strength in its jaws, and its incapacity for swift motion through the water, by the suddenness and agility of the attack which they enabled it to make on every animal fitted for its prey.

The appearance of the animal, which is far less formidable than that of the ichthyosaurus, shows that it was more adapted to occupy the tranquil waters of sheltered creeks and bays than to brave the rough breakers of the deep. The first almost entire skeleton of plesiosaurus was obtained in 1824, and since then a large number of species have been established. From the connected and almost perfect state of the skeletons of ichthyosauri and plesiosauri, as if prepared by an anatomist, these animals appear to have been suddenly destroyed and immediately embedded. As we know that river fish are sometimes stifled, even in their own element, by muddy water, during floods, it cannot be doubted that the periodical discharge of large bodies of turbid fresh water into the sea may be still more fatal to marine tribes. Large quantities of mud and drowned animals have been swept down into the sea, by rivers, during earthquakes, as in Java some years since; and indescribable multitudes of dead fishes have been seen floating on the sea, after a discharge of noxious vapors, during similar convulsions.

A Monstrous Creature of the Pre-Historic Age.

Contemporaneously with these strange animals, marine, fresh-water, and terrestrial tortoises flourished, with crocodiles of extinct species, and the pterodactyle, or wing-fingered reptile, perhaps the most singular and monstrous creature of the ancient world, the type of which appears in no living genus. This flying reptile had such a remarkable construction that it puzzled scientific men. Naturalists pored over its remains, but were unable to assign them to their true place in the animal kingdom, some pronouncing it a bird, others a reptile, and others a bat, till Cuvier took its skeleton in hand. Behold, he observes, an animal, which, in its bone formation, from its teeth to the end of its claws, is like a reptile; nor can we doubt that those characteristics existed in the muscles and soft parts, in its scales,* its circulation, and other organs. But it was, at the same time, an animal provided with the means of flight, which, when stationary, could not have made much use of its anterior extremities, even if it did not keep them always folded as birds keep their wings; which, nevertheless, might use its small anterior fingers to suspend itself from the branches of trees, but when at rest must have been ordinarily on its hind feet, like the birds, again; and also, like them, must have carried its neck sub-erect, and



THE GREAT FISH-LIZARD AND FLYING REPTILE.

curved backwards, so that its enormous head should not interrupt its equilibrium. Pterodactyles had the head and neck of a bird, the mouth and teeth of a reptile, the wings of a bat, the body and tail of one of the lower orders of animals. Their eyes were enormously large so that they could seek their prey in the night. They could not only fly, but like the existing vampire bat, they had the power of swimming. Thus, like Milton's fiend, qualified for all services and all elements, the pterodactyle was a fit companion for the kindred reptiles that swarmed in the seas, or crawled on the shores of a turbulent planet

The fiend,
O'er bog, or steep, through strait, rough, dense, or rare,
With head, hands, wings, or feet pursues his way,
And swims, or sinks, or wades, or creeps, or flies.

Cuvier, in his great work, pronounces these flying reptiles the most extraordinary of all the beings whose ancient existence is revealed to us; and those which, if alive, would seem most at variance with living forms. Many species have been determined, most of them varying from the size of a snipe to that of a cormorant. It is estimated that the expanded wings of this creature measured six feet in width.



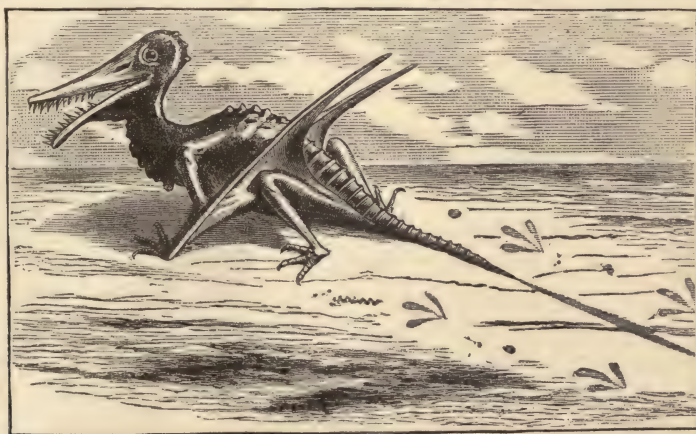
FOSSIL SKELETON OF THE PTERODACTYLE.

Another reptile allied to the pterodactyle lived in this epoch. It was the ramphorynchus, and was distinguished from the former by a long tail. The imprints which this animal has left upon the sandstone of the period indicate at once the impression of its feet and the linear furrow left by its tail. Like the pterodactyle, the ramphorynchus, which was a very strange creature, could not precisely fly, but, aided by the natural parachute formed by the membrane connecting the fingers and the body, it could throw itself from a height upon its prey. The footprints in the

soil are those which always accompany the remains of the ramphorynchus in the rocks, and they show the imprints at once of the anterior and posterior feet and tail.

Extraordinary Land Reptiles.

Not less remarkable than these inhabitants of the ocean and the air were the land reptiles of the same period, the iguanodon and megalosaurus. The iguanodon had a very singular structure. Although the size and proportions of its body and limbs have been determined from numerous detached bones, and the few specimens in which several are collected in the same block of stone, yet but a vague idea of the form and appearance of the original animal can be derived from the relics hitherto discovered. We may, however, safely conclude that the body of the iguanodon was equal in magnitude to that of the elephant, and as massive in its



THE RAMPHORYNCHUS OR CREEPING BIRD.

proportions; for being a vegetable feeder, a large development of the abdominal region may be inferred. Its limbs must have been of a proportionate size to sustain so enormous a bulk; one of the thigh bones, if covered with muscles and tissues of suitable proportions, would form a limb seven feet in circumference. The hinder extremities, in all probability presented the unwieldy shape of those of the hippopotamus or rhinoceros, and were supported by very strong, short feet, the toes of which were armed with claws, like those of certain turtles. The fore legs appear to have been less bulky, and were furnished with hooked claws. The teeth demonstrate the nature of the food required for the support of this herbivorous reptile, and the power of mastication it enjoyed; and the ferns, pines and hemlock trees, with which its remains are associated, indicate the vegetation adapted for its sustenance. But the physiognomy of this creature,

from the peculiar shape of the skull and jaws required for the attachment and support of the powerful muscles necessary for the grinding of tough vegetable substances, must have differed entirely from that of all known reptiles.

The length of the iguanodon has been variously estimated; the difference in the computation depending chiefly on the extent assigned to the tail, which in many lizards is much longer than the body. If the tail of the fossil reptile was slender, and of the same relative proportions as in forms now existing, the largest individual would be fifty or sixty feet long.

Remains of the megalosaurus have been found in several localities. So many perfect bones and teeth have been discovered that we are nearly as well acquainted with the form and dimensions of the limbs as if they had been found together in a single block of stone. The restoration of the animal had been accordingly effected agreeably with the proportions of the known parts of the skeleton, and in harmony with the general characters of the order of reptiles to which the megalosaurus belonged. Baron Cuvier estimated this animal to have been about fifty feet in length. Calculations founded on more complete evidence reduce its size to about thirty-five feet; but with the superior proportional height and capacity of trunk as contrasted with the largest existing crocodiles, even that length gives a very formidable character to this extinct rapacious reptile. The restoration, according to the proportions of fossil bones of the megalosaurus hitherto obtained, yields a total length of the animal, from the muzzle to the end of the tail, of thirty-seven feet, the length of the head being five feet, the length of the tail fifteen feet, and the greatest girth of the body twenty-two feet six inches. As the thigh bone and leg bone measure each nearly three feet, the entire hind leg must have attained a length of two yards, and indicated a foot, with the toes and claws entire, of at least three feet in length. The form of the teeth shows the megalosaurus to have been strictly a flesh-eating creature, and these were fearfully fitted to the destructive office for which they were designed. They appear straight when young, but become slightly bent backwards in the progress of growth, and the fore part of the crown, below the summit becomes thick and convex. They present a combination of contrivances similar to those which human ingenuity has adopted in the construction of the knife, the sabre, and the saw.

Enormous Lizards of the Prehistoric Age.

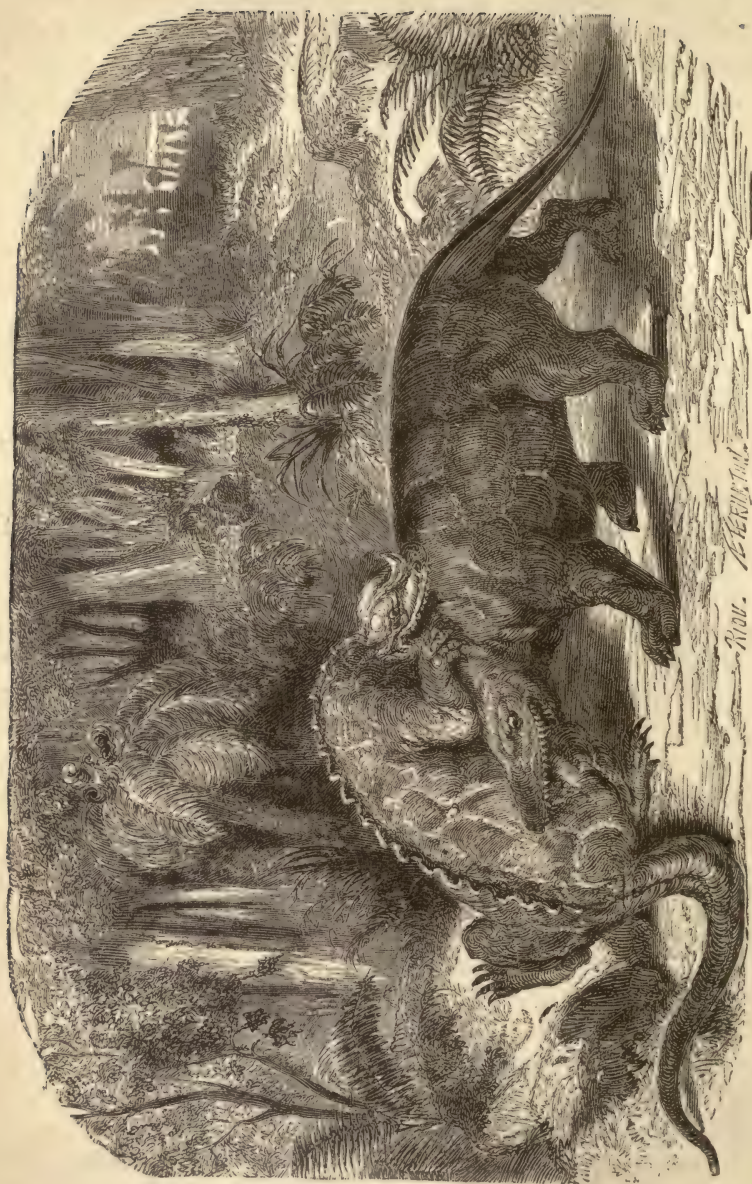
The world-renowned naturalist, Figuier, thus describes this gigantic reptile: The megalosaurus was an enormous lizard, borne upon feet slightly raised: its length reached about forty-five feet. Cuvier consider-

ed that it partook of the structure of the reptiles which haunt the banks of the Nile and tropical India. The complicated structure and marvellous arrangement of the teeth prove that it was essentially a flesh-eating animal. It fed probably on other serpents of moderate size, such as the crocodiles and turtles which are found in the fossil state in the beds. The lower jaw supports many teeth: it shows that the head terminated in a straight muzzle, thin and flat on the sides, like that of the gavial, the crocodile of India. The teeth of the megalosaurus were in perfect accord with the destructive nature of this formidable creature. They partake at once of the knife, the sabre and the saw. Vertical at their junction with the jaw, they assume with the increased age of the animal a backward curve, giving them the form of a gardener's pruning-knife. After insisting upon some other particulars respecting these teeth, Buckland says, "With teeth constructed so as to cut with the whole of their concave edge, each movement of the jaws produced the combined effect of a knife and a saw, at the same time that the point made a first incision like that made by the point of a double-cutting sword. The backward curvature taken by the teeth at their full growth renders the escape of the prey when once seized impossible. We find here, then, the same arrangements which enable mankind to put in operation many of the instruments which they employ."

The Colossal Iguanodon.

Figuier also says concerning the iguanodon that it was more gigantic than the megalosaurus: the most colossal, indeed, of all the reptiles of the ancient world which research has yet exposed to the light of day. The form and disposition of the feet, added to the existence of a horn on the upper part of the muzzle or snout, render this creature one of the marvels of the ancient world. The bone of its thigh surpasses that of the elephant, the shape of this bone and feet demonstrates that it was formed for travelling inland; and its dental system shows that it was herbivorous. The teeth which are the most important and characteristic organs of the whole animal, are not fixed in distinct sockets like the cocodiles, but fixed on the internal face of a dental bone; that is to say, in the interior of the palate, as in the lizards. The place thus occupied by the edges of the teeth, their trenchant and saw-like form, their mode of curvature, the points where they become broader or narrower which turn them into a species of nippers or scissors—are all suitable for cutting and tearing the resisting plants which are also found among the remains with the reptile.

We present an engraving in which the iguanodon and megalosaurus



IMMENSE PRE-HISTORIC ANIMALS—THE IGUANODON AND MEGALOSAURUS.

struggle for the mastery in the centre of a forest, which enables us also to convey some idea of the vegetation of the period. Here we note a vegetation at once exotic and temperate—that of the tropics, and a flora resembling our own. On the left we observe a group of trees, which resemble some of the plants of our forests. An entire group of trees, composed of ferns, are in the background; in the extreme distance are some palms. We also recognize in the picture the alder, the wych-elm, the maple, and the walnut-tree, or at least species similar to these.

A Marvelous Reptile.

The hylæosaurus was another enormous reptile, whose remains were found in the Tilgate Forest. This animal appears to have combined some of the features both of the crocodile and of the lizard. It was covered



A HUGE BONE-PLATED ANIMAL—THE HYLÆOSAURUS.

with thick scales, and along the back was a row of long conical bones or spikes, resembling the crests. This animal is supposed to have been a terrestrial, herbivorous reptile, between twenty and thirty feet in length. Altogether it must have been of the most extraordinary reptilian organization.

When the ichthyosaurus and plesiosaurus ceased to rule the ocean and become extinct, the mososaurus took their place, to keep the multiplication of the species of other animals within proper limits. The mososaurus derives its name from the locality, Maestricht, on the River Meuse, in Germany, where its remains have been chiefly discovered,

and from the Greek word *sauros*, a lizard, to which tribe of animals it belongs. The occasional discovery of bones and teeth of an unknown animal in the limestone has long since directed the attention of naturalists to the quarries of St. Peter's Mountain.

Discovery of an Immense Fossil Skeleton.

In 1770, M. Hoffmann, who was forming a collection of organic remains, discovered a specimen, which has conferred additional interest on this locality. Some workmen, on blasting the rock in one of the caverns of the interior of the mountain, perceived, to their astonishment, the jaws of an enormous animal attached to the roof of the chasm. The discovery was immediately made known to M. Hoffmann, who repaired to the spot, and for weeks presided over the arduous task of separating from the rock the mass of stone containing the remains. His labors were at length repaid by the successful extrication of the specimen, which he conveyed triumphantly to the house. Unfortunately, the canon of the cathedral, which stands on the mountain, claimed the fossil in right of being lord of the manor, and succeeded, by a most unjust and expensive lawsuit, in obtaining this precious relic. It remained in his possession for years, and Hoffmann died without regaining his treasure, or receiving any compensation. The French revolution broke out, and the armies of the republic advanced to the gates of Maestricht; the town was bombarded, but by the desire of the committee of scientific men who accompanied the French troops, the artillery was not allowed to play on that part of the city in which the celebrated fossil was known to be contained. In the meanwhile, the canon, shrewdly suspecting why such peculiar favor was shown to his residence, concealed the specimen in a secret vault; but when the city was taken, the French authorities compelled him to give up his ill-gotten prize, which was immediately transmitted to the zoological garden at Paris, where it still forms one of the most striking objects in that magnificent collection. The entire length of the mososaurus has been estimated at from twenty-five to thirty feet; the number of its spinal joints is one hundred and thirty-three. Its skull measures four and a half feet in length, and two and a half feet in width. In the more recent deposits, the remains of immense animals are found in great numbers; among the most remarkable of these is the mammoth or fossil elephant. Bones and tusks of elephants or mastadons occur throughout Russia, and more particularly in Eastern Siberia and the arctic marshes. The tusks are very numerous, and in so high a state of preservation that they form an article of commerce, and are employed in the same works as what may be termed the living ivory of Asia and



GIGANTIC SKELETON OF THE MAMMOTH IN THE MUSEUM AT ST. PETERSBURG.

Africa, though the fossil trunks fetch an inferior price. Siberian fossil ivory forms the principal material on which the Russian ivory-turner works. The tusks most abound on the shores of the Frozen Sea, and the best are found in the countries near the arctic circle, and in the most eastern regions, where the soil in the very short summer is thawed only at the surface; in some years not at all.

Discovery of an Enormous Mammoth.

In 1799 a Tungusian named Schumachoff, who generally went to fish and hunt at the peninsula of Tamut after the fishing season of the Lena was over, had constructed for his wife some cabins on the banks of Lake Oncoul, and had embarked to seek along the coasts for tusks, called horns by the people of that region. One day he saw among the blocks of ice a shapeless mass, but did not then discover what it was. In 1800 he perceived that this object was more disengaged from the ice, and that it had two projecting parts, and towards the end of the summer of 1801 the entire side of the animal and one of his tusks was quite free from ice. The summer of 1802 was cold, but in 1803 part of the ice between the earth and the mammoth, for such was the object, having melted more rapidly than the rest, the plane of its support became inclined, and the enormous mass fell by its own weight on a bank of sand. In March, 1804, Schumachoff came to his mammoth, and having cut off the tusks, exchanged them with a merchant for goods of the value of forty dollars. For some years the flesh of this animal was cut off for dog-meat by the people around, and bears, wolves, gluttons, and foxes fed upon it till the skeleton was nearly cleared of its flesh. About three-fourths of the skin, which was of a reddish-gray color, and covered with reddish wool and black hairs about eight inches long, was saved, and such was its weight that it required ten men to remove it; the bones of the head, with the tusks, weighed four hundred and sixteen pounds. The skeleton was taken to St. Petersburg, where it may still be seen in the Museum of Natural History. This animal must have been twice the ordinary size of the existing elephant, and it must have weighed at least twenty thousand pounds.

There is not in the whole of Asiatic Russia any brook or river, especially of those which flow in the plains, on the banks of which some bones of elephants and other animals foreign to the climate have not been found. But in the more elevated regions, they are wanting, as are the marine petrifications. But in the lower slopes and in the great muddy and sandy plains, above all, in places which are swept by rivers, they are sure to be found, which proves that we should not the less find them

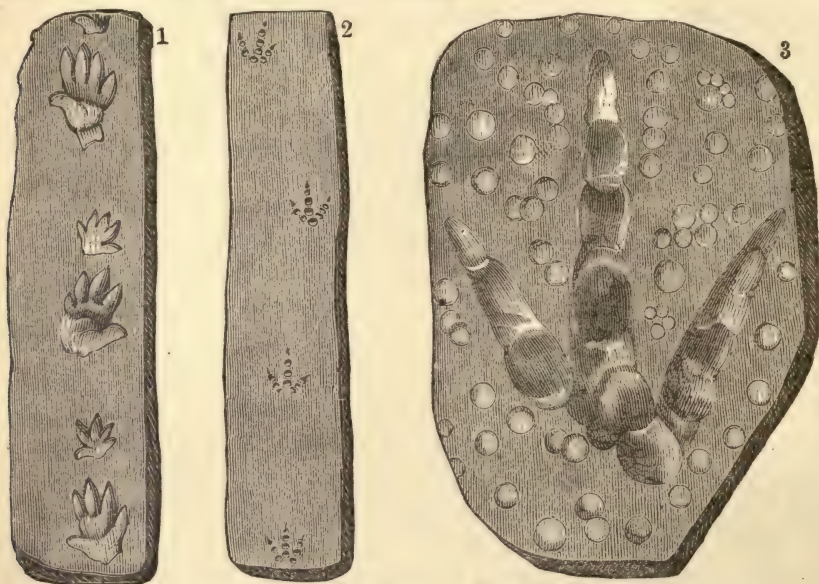
throughout the whole extent of the country if we had the same means of searching for them. Every year in the season of thawing, the vast rivers which descend to the Frozen Ocean in the north of Siberia sweep down with their waters numerous portions of the banks, and expose to view the bones buried in the soil and in the excavations left by the rushing waters. It is curious that the more we advance towards the north of Russia the more numerous and extensive do the bone repositories become. In spite of the undoubted testimony, often repeated, of numerous travellers, we can scarcely credit the statements made respecting some of the islands of the glacial sea near the poles, situated opposite the mouth of the Lena and of the Indigirska. All the islands nearest to the main land, which is about thirty-six leagues in length, except three or four small rocky mountains, are a mixture of sand and ice, so that when the thaw sets in and their banks begin to fall many mammoth bones are found. All the isle is formed of the bones of this extraordinary animal, of the horns and skulls of buffaloes, or of an animal which resembles them, and of some rhinoceros horns.

Quarries of Fossil Ivory.

New Siberia and the Isle of Lachon are for the most part only a mass of sand, of ice, and of elephants' teeth. At every tempest the sea casts ashore new quantities of mammoths' tusks, and the inhabitants of Siberia carry on a profitable commerce in this fossil ivory. Every year during the summer innumerable fishermen's barks direct their course towards this isle of bones, and during winter immense caravans take the same route, all the convoys drawn by dogs, returning laden with the tusks of the mammoth, weighing each from 150 to 200 pounds. The fossil ivory, thus withdrawn from the frozen north is imported into China and Europe, where it is employed for the same purpose as ordinary ivory, which is furnished, as we know, by the elephant and hippopotamus of Africa and Asia. The isle of bones has served as a quarry of this valuable material for export to China for five hundred years, and it has been exported to Europe for upwards of a hundred. But the supply from these strange mines remains undiminished. What a number of accumulated generations of these bones and tusks does this profusion imply!

The abundance of the remains of fossil elephants in the Russian steppes has given birth to a legend of a very ancient origin. The Russians of the north believe that these bones proceed from an enormous animal which lived, like the mole, in holes which it dug in the earth; it could not bear the light, says the legend, but died when exposed to it. A circumstance curious enough is that this same legend of an animal living

underground has spread to China. We read in the great Chinese work on Natural History, composed in the sixteenth century, of an animal that was called by a name signifying the mouse, which hides itself. The description says, it constantly confines itself to subterranean caverns; it resembles a mouse, but is of the size of a buffalo or ox. It has no tail; its color is dark; it is very strong and excavates caverns in places full of roots, and covered with forests. Another writer thus expresses himself: This monster haunts obscure and unfrequented places. It dies as soon as it is exposed to the rays of the sun or moon; its feet are short in proportion to its size. Its tail is as long as that of a Chinese. Its eyes are small, its neck short. It is very stupid and sluggish.



I. FOOTPRINTS OF THE LABYRINTHODON IN SANDSTONE. 2. FOOTPRINTS OF A BIRD. 3. FOOTPRINTS OF A BIRD AND IMPRESSION OF RAIN DROPS.

In 1834 an account was published of some remarkable fossil footsteps in the new red sandstone in Saxony. The largest track appears to have been made by an animal whose hind foot was eight inches long, the fore foot being much smaller. It received the name of *chirotherium*, owing to the resemblance of its impressions to the shape of the human hand. Fossil skulls, jaws, teeth, and a few other bones of this animal, have since been discovered, and from some characteristics which they possess—found at the present day only in frogs and salamanders, and from the proportionate size of its fore and hind feet, also a characteristic

of the toad and frog—this extinct animal is supposed to have been a huge frog. It has more recently received the name of labyrinthodon, from the peculiar structure of its teeth, which, under the microscope, present a series of irregular folds, resembling the labyrinthic windings of the human brain. The pictorial representation in the following chapter is from a model at the London Crystal Palace. Later a variety of tracks, referred to the chirotherium, tortoises, and reptiles were discovered in the new red sandstone in the neighborhood of Liverpool. The largest footprint was nine inches long, and six inches broad, the length of the step approaching to two feet. Abundant footprints along with ripple marks, have been found on layers of the forest marble, to the north of Bath. A communication to the Journal of Science, in 1836, by President Hitchcock, of Amherst College, called attention to some very distinct tracks in the red sandstone of the Connecticut valley, resembling the impressions left on the muddy banks of the river by the aquatic birds now common to the locality.

Marks of Rain Drops in Solid Rocks.

Similar impressions of rain drops occur in the Storeton quarries, where tracks of the chirotherium are found. The under surface of the strata, at the depth of thirty-two or thirty-five feet, presents a remarkably blistered or watery appearance, being densely covered by minute hemispheres of the same substance as the sandstone. The impressions are sometimes perfect hemispheres, indicating a vertical fall of rain; but in other cases they are irregular and elongated in a particular direction, as if the drops had struck the surface obliquely, indicating a wind accompanying the rain. President Hitchcock mentions specimens of sandstone in his possession, obtained from various parts of the United States, which show footprints, ripple marks and rain drops, the latter evincing, by a uniform elongation of shape, the direction of the wind when the rain fell.

Walking along our shores in the present day, we observe a well-defined cast of our own footstep left in the sand still wet from the retreating tide, and similar distinct impressions made by the passage of animals and birds across it, and by the descent of a shower of rain upon it. In the same manner it is probable that the tracks which the new red sandstone presents were formed on the shores of an estuary, or a tidal river, between high and low water mark—then dried and hardened by the action of the sun and air during the subsiding of the waters—the returning waves washing up mud to cover up the impressions, the two layers uniting, to exhibit, if ever separated, the one a mould, and

the other a cast from it, of the forms that have been there. The observation of like phenomena, now, to these unfolded by this geological formation, are of no mean importance and interest to mankind, in every condition of society. Many a depredator has been detected by the correspondence of his foot to its imprint in the snow or loose earth near the place of his crime. The North American Indian finds his enemy by his trail, and can not only distinguish between the elk and the buffalo by the marks of their hoofs, but determine with great exactness the space of time that has elapsed since the animals have passed. In the deserts of Africa, the track of the camels proclaims to the Arab whether a heavily or lightly laden caravan has crossed the sands. But



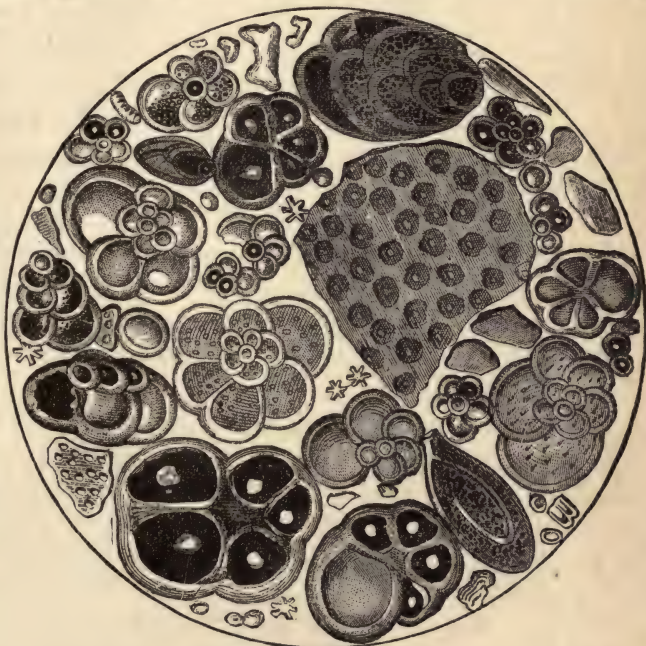
CHALK UNDER THE MICROSCOPE.

from the imprints presented by the sandstone formation, we gather information respecting what transpired many thousands of years ago, catch a glimpse of the gigantic birds and strangely formed quadrupeds that then existed, and even have indicated to us, in a manner so plain as not to be mistaken, the direction from which the wind blew while a shower of rain was falling.

We find embedded in the earth the fossil remains of vast quantities

of animals no less remarkable for their minuteness and construction than those already described in the preceding pages are for their colossal size. They are called animalcules, or infusoria. Their skeletons constitute nearly the whole mass of some soils and rocks, many feet in thickness, and extending over areas of several miles. Such is the polishing slate, in Bohemia, which occupies a surface of great extent, probably the site of an ancient lake, and forms slaty strata of fourteen feet in thickness, almost wholly composed of the shields of animalcules. The size of a single one, forming the polishing slate, amounts upon an average, and in the greatest part, to one-sixth of the thickness of a human hair. Such is the statement of

Ehrenberg, which naturally suggests the reflection of the French philosopher, that if the Almighty is great in great things, he is still more so in those which are minute; and furnishes additional data for the well known moral argument of the theologian, derived from a comparison of the telescope and the microscope: The one led me to see a system in every star; the other leads me to see a world in every atom. The one taught me that this mighty globe, with the whole burden of its people and of its countries, is but a grain of sand on the high field of immensity; the other teaches me that every grain of sand may harbor within it the tribes and the families of a busy population. The one told me of the insignificance of the world I tread upon; the other redeems it from all insignificance—for it tells me that in the leaves of every forest and in the flowers of every garden, and in the waters of every rivulet, there are worlds teeming with life, and numberless as the stars above.



FOSSIL REMAINS IN CHALK.

The composition of the polishing slate of Bohemia is far from being unique; for in several other European localities, and very largely in America, strata consisting mainly of fossil animalcules have been observed. This is the case with the infusorial earth of Virginia, a yellowish clay, forming a deposit from twelve to fifteen feet in thickness, upon which the towns of Richmond and Petersburg are built. The surface of the country over which it extends is characterized by a scanty vegetation, owing to the nature of the soil dependent on the minute organisms of which it almost entirely consists. When a few grains of this earth are properly prepared for microscopic examination, immense numbers of the shields or

cases of animalcules are visible under a magnifying power of three hundred diameters; in fact, the merest stain left by the evaporation of water in which some of the marl has been mixed, teems with these fossil remains. The farther we pursue our investigations in this direction, the more wonderful do the discoveries become.

These organisms are of exquisite structure and comprise many species and genera. The most beautiful and abundant are the circular shields, which are elegant saucer-shaped cases, elaborately ornamented with openings disposed in curves, somewhat resembling the machine-turned sculpturing of a watch. These shells are from one-hundredth to one-thousandth of an inch in diameter. The body of the living animalcule was protected and enclosed by a pair of these concave shells.

The Smallest Creatures ever Discovered.

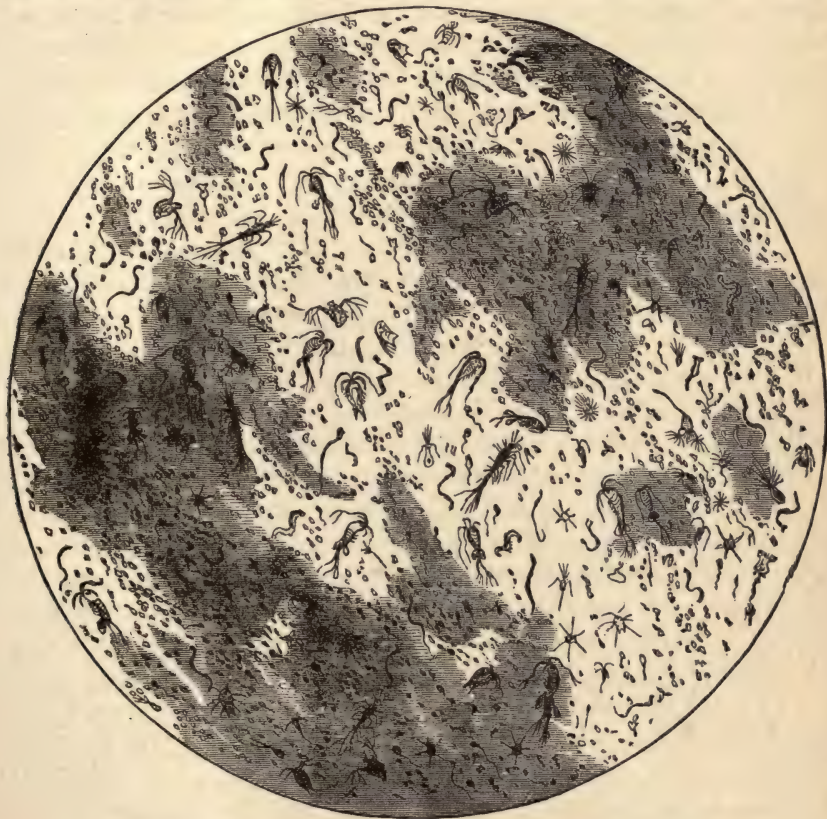
Beds of infusorial earth occur in almost every quarter of the globe. A large proportion of the sand of the Libyan desert consists of microscopic fossil remains; and the marine sands of the Paris basin are in some localities so full of microscopic forms, that it is calculated that a cubic inch of the mass contains sixty thousand. Many of the peat bogs of Ireland contain layers of a white, earthy substance, which, when dry, is of the appearance and consistence of brittle chalk, and this consists of the cases of animalcules.

Infusoria abound also at the present time. They are generally to be found in stagnant pools, and not unfrequently in springs, rivers, lakes and seas; also in the internal moisture of living plants and animal bodies, and are probably at times carried about in the vapor and dust of the atmosphere. Unlike the larger animals, throughout the whole of which we can trace one common type, the forms of these minute creatures are varied and singular. Some are egg-shaped, others resemble spheres; others again different kinds of fruit, funnels, tops, cylinders, pitchers, wheels, flasks, eels, serpents and many classes of animals with jointed skeletons.

Some of the animalcules are visible to the naked eye, as moving points though the smallest are not more than the 24,000th of an inch in diameter, a single drop of water having been estimated to contain many thousands of them. They were formerly supposed to be little more than mere particles of matter endowed with vitality; but Ehrenberg has discovered in them an apparatus of muscles, intestines, teeth, different kinds of glands, eyes, nerves, and organs of reproduction. They not only propagate by eggs, but by self-division; and are the most reproductive of all organized bodies. They possess a comparatively long life, and in general main-

tain themselves pretty uniformly against all external influence, as do larger animals. As far as is yet known, they appear to be sleepless.

It cannot but be a matter of great interest to learn, if possible, the use of these minute animals in the economy of nature. That they are not merely accidents in creation we may be quite certain, and that they simply enjoy life and do not contribute to the well-being of the whole, may be considered equally improbable, and too unlike the ordinary course of



A DROP OF WATER AS SEEN UNDER THE MICROSCOPE.

nature to be admitted for a moment. All things work together, and we may in all cases, safely inquire concerning the adaptation of any group, however minute or apparently unimportant it may at first appear.

It has been ingeniously suggested by Professor Owen that these little creatures are the appointed devourers of organic matter immediately before its final decomposition into inorganic elements. For, consider, says he, their incredible numbers, their universal distribution, their insatiable

voracity, and their invariable presence wherever animal or vegetable matter is undergoing decomposition in water. Surely we must be indebted to them—the ever active and invisible scavengers of the world—for the salubrity of our atmosphere; but they perform a still more important office, perhaps, in preventing the gradual diminution of the present amount of organized matter upon the earth. And it is not difficult to understand in what way this result is produced, for, when the organic matter is in that state of comminution and decay which immediately precedes its return from the organic to the inorganic world, these wakeful members of nature's invisible police are everywhere ready to arrest the fugitive particles, and turn them back into the ascending stream of animal life. Becoming the food of the smaller infusorial animalcules, they again supply the voracity of the larger ones, and of numerous other small animals, which in their turn are devoured by larger ones, and so, by degrees, the substance fit for the nourishment of the most highly organized classes is brought back by a short route from the extremity of the realms of organized matter.

Skeletons Traveling in the Air.

It is a remarkable and very interesting fact with regard to these animalcules, that their light skeletons, are capable of being transported by the air in the form of fine dust to the distance of many hundred miles out at sea; and the quantity so transported is often sufficient to cloud the air, and form a sensible deposit on the decks and rigging of ships. The microscope alone is capable of proving whence this dust comes, but, with its aid, they can be recognised, identified, and traced to that continent or island, which is not always the one nearest at hand, where they are indigenous. It will not be surprising, also, since we thus find the bodies of the animalcules themselves carried along by millions through the air, that their eggs may be carried yet farther, and prove a bond of union between distant lands, whose other inhabitants have no relation. Who could have imagined that the atmosphere is in this way the means of conveying to distant spots the invisible stony frame-work and the eggs of these little bodies? And yet it is impossible to doubt the importance of such a means of communication in the animal economy.

The first animals produced, after the infusorias and microscopic plant-animals, in the still warm, dense waters of the primeval seas, were such as sea-stars and sea-hedgehogs, whose very numerous organs present a symmetry absent in the infusorias. These beautiful flower-like zoophytes, covered the bottom of the sea where they were planted, rising, like a submarine forest, to an elevation of several yards. The various solid parts of

their bodies had already some analogy with those constituting the skeleton of the superior animals, and thus formed, around a stem or vertebral column, a complex framework destined to protect the vital organs.

Innumerable Insects Building Islands.

Animals of this low organization multiply rapidly, and are capable of making very important geological deposits. While, indeed, the vertebrated animals and the larger and more complicated molluscs live for some considerable time, and modify during that time the general conditions of organic existence, these little creatures may, by their rapid secretion of solid matter from the water, and (owing to their brief existence) equally rapid deposition of it in a solid form, lay the foundation of islands, and even of new continents. The land thus formed may, when brought above the sea level, be destined to last, with little change, throughout many successive geological epochs, during which group after group of species of the higher animals may be introduced and destroyed, some of which leave no indication of their ever having existed, while others are represented by a few bones, a tooth, a scale, or perhaps only by the faint impress of a footstep.


How important, then, it becomes that we should understand these, the common hieroglyphics, even if their meaning is less full, and when they speak an earlier and a simpler language than the others, since the sacred characters which tell of higher events are so infinitely more rare, and for that reason also more difficult to render. The most enduring monuments of man himself—his cities, his pyramids, and his lofty columns—are, in many cases, built of these far more ancient and far more lasting objects, which withstand the shock of earthquakes and the hand of time, and which scarcely yield, even at last, to the slow influence of crystalline forces, re-arranging the particles by the aid of heat and electricity.



CHAPTER II.

PRE-HISTORIC MONSTERS OF LAND AND SEA.

Astonishing Convulsions and Physical Revolutions—Fabulous Traditions—Histories of Reptiles Written in Stone—Gigantic Inhabitants of the Ancient Globe—Skeletons of Extinct Animals found in Rocks—A Winged Monster—Combat Between Enormous Reptiles—The Huge Megalosaurus—A Vampire of the Pre-Historic Age—A Creature Curiously Constructed—The Wing-Fingered Bird—The Famous Iguanodon—A Vivid Picture of the Early Ages—Animal Life in the Oolitic Period—A Dragon on Wings—The Remarkable Dinotherium—The Strange Hand-Animal—The Glyptoden—The Primeval Armadillo—A Creature that could Swallow an Ox—Megatherium—Animals in Mortal Combat—A Bird Without Wings—Flowers and Plants in Stone—Fossil Fishes—Beautiful Shells.

HE observer who glances over a rich and fertile plain, watered by rivers and watercourses which have, during a long course of ages, pursued the same uniform and tranquil course; the traveler who contemplates the walls and monuments of a great city, whose foundations are lost in the night of ages, witnessing, apparently, to the unchangeableness of things and places; the naturalist who examines a mountain or other locality, and finds the hills and valleys and other accidents of the soil in the very spot and condition in which they are described by history and tradition;—neither of these inquirers would at first suspect that any serious subversion had ever occurred to disturb the surface. Nevertheless, the spot has not always presented the calm aspect of stability which it now exhibits; in common with every spot of earth, it has had its convulsions, its physical revolutions, whose story we are about to trace. Buried in the depths of the soil, for example, in one of those vast excavations which the intrepidity of the miner has dug, in search of coal and other minerals and metals, there are numerous phenomena which strike the mind of the inquirer, and carry their own conclusions with them. A striking increase of temperature occurring in these subterranean places is one of the most remarkable of these. It is found that the temperature of the earth rises one degree for every sixty or seventy feet of descent from its surface.

If the interior of the beds be examined minutely, if, armed with the miner's pick and shovel, the surrounding earth is dug up, it is not impossible that the very first efforts at mining may be rewarded by the discovery of some fossil form no longer found in the living state. The remains of

plants, and animals belonging to the first ages of the world, are, in fact, very common; entire mountains are formed of them, and, in some localities, the soil can scarcely be touched at a certain depth without yielding fragments of bones and shells, or the impression of fossilized animals and vegetables, the buried remains of extinct creations. These bones—these remains of animals or vegetables which the pick of the young geologist has torn from the soil—belong probably to some organic species which no longer exists anywhere: it cannot be compared to any animal or plant living in our times; but it is evident that these beings, whose remains are now so deeply buried, have not always been so covered; they lived on the surface of the earth as plants and animals do in our days, for their organization is essentially the same. The beds in which they now repose, then, must in other times have formed the surface; and the presence of these bones and fossils proves that the earth has suffered great changes.

These remains of the primitive creation had long been examined and classed scientifically as freaks of nature, for so we find them described in the works of the ancient philosophers who wrote on natural history, and in the few treatises on natural history which the middle ages have bequeathed to us. Fossil bones, especially those of elephants, were known to the ancients, giving birth to all sorts of legends and fabulous histories: the tradition which attributed to Achilles, to Ajax, and the other heroes of the Trojan war, a height of twenty feet, was traceable no doubt to the discovery of the bones of elephants near their tombs. In the time of Pericles we are assured that in the tomb of Ajax a knee-bone of that hero was found, which was as large as a dinner-plate. This was probably only the fossilized knee-bone of an elephant.

Tracks of Reptiles in Stone.

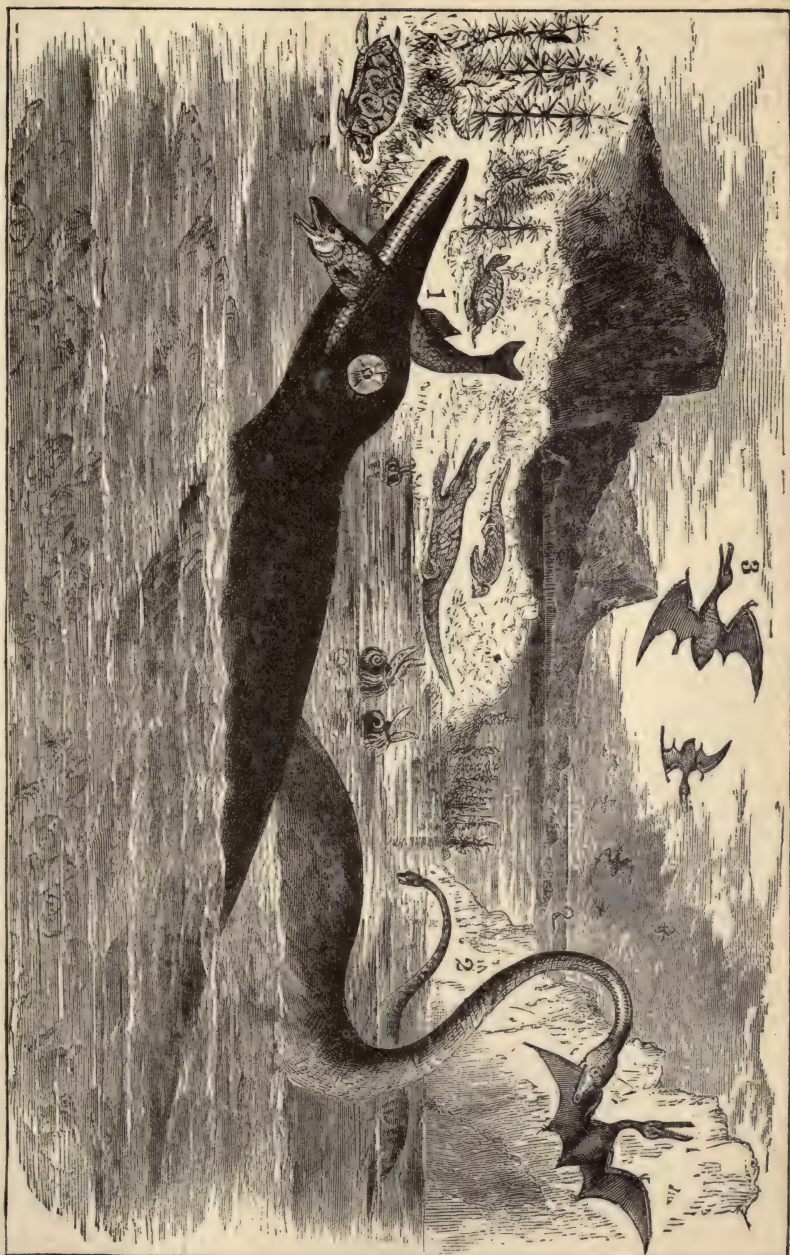
The imprints left upon the earth or sand, which time has hardened into sandstone, furnish to the geologist a series of valuable indications. The reptiles of the ancient world, the turtles in particular, have left upon the sands, which time has transformed into blocks of stone, imprints which evidently represent the exact mould of the feet of these animals. These impressions have sometimes been sufficient for naturalists to determine to what species the animal belonged which thus left its impress on the wet soil. Some of these present traces of the steps of the great reptile known as the labyrinthodon or cheirotherium, whose foot resembles the hand of a man. Another well-known impression is supposed to have been the impress of the foot of some great turtle.

The historian and antiquarian may traverse the battle fields of the Greeks and Romans, and search in vain for traces of these conquerors, whose

armies ravaged the world. Time, which has overthrown the monuments of their victories, has also effaced the imprint of their footsteps; and of millions of men besides, whose invasions have spread desolation over Europe, there is not even a trace of their footsteps. These reptiles, on the contrary, which ranged for thousands of years on the surface of our planet when still in its infancy, have impressed on the soil indelible recollections of their existence. Hannibal and his legions, the barbarians and their savage hordes, have passed over the land without leaving a material mark of their passage, while the poor turtle which drags itself along on the silent shore of the primitive seas has bequeathed to learned posterity the image and imprint of a part of its body. These imprints may be perceived as distinctly marked on the rocks as the traces left in moist sand or in newly-fallen snow by some animal under our own eyes. What grave reflections should be awakened within us at the sight of these blocks of hardened earth, which thus carry back our thoughts to the first ages of the world, and how insignificant the discoveries of the archæologist who throws himself into ecstasies before some piece of Greek or Etruscan pottery, when compared with these veritable antiquities of the earth!

Vast Antediluvian Forests.

As already observed, the products of the first epoch of the globe were vegetable, consisting of immense forest growths, from which vast coalbeds were formed to furnish fuel for the subsequent races of men. The secondary epoch contrasted strongly with that which preceded it, for now the wonders of animal life burst upon us with their unique and fantastic shapes. The reptiles astonish us by their number, their gigantic size, and their unwonted forms; antique and incomprehensible inhabitants of the globe, reproduced in all their parts to our wondering eyes by the genius of a Cuvier and an Owen! It is to this epoch that the name of the reptilian age may be most appropriately given, so completely did these creatures then predominate on the globe; it was the age of a throng of frightful lizards, compared to which our own are mere pigmies, and which possessed a form and character of their own. At this time lived the *ichthyosauri*, veritable fish-lizzards, as is indicated by their name. These reptiles, which must have spread terror through the ancient seas, attained an enormous length. Their whole organization is a series of surprises. With the vertebræ of the fish they have the fins of a dolphin; and while armed with the teeth of a crocodile, they display an optic globe which is without any parallel. This eye, the bulk of which was sometimes as large as a man's head, was protected in front by a framework of bony plates, and was beyond all doubt the most powerful and perfect



EXTINCT ANIMALS, THE SKELETONS OF WHICH ARE FOUND IN THE INTERIOR OF SOLID ROCKS,
1.—*ICHTHYOSAURUS*, 2.—*PLESIOSAURUS*, 3.—*PTERODACTYLE*.

visual apparatus ever seen in creation. Hence the ichthyosauri could discover their prey at the greatest as well as the shortest distances; in the profound darkness of night, and in the depths of the ocean; the delicate structure of the organ of vision being protected from the shock of the waves by the bony buckler which surrounds the transparent globe.

Naturalists have investigated the remains of these animals with such skill, that in spite of the destruction of the softer organs thousands of years ago, they have been enabled to make out the structure of the intestinal tube! It has been shown that this was formed exactly like an Archimedian screw, and was strictly analogous to that of our sharks and rays. At the same time the nature of the food of these voracious reptiles has been discovered. The petrified remains of food which were found proved that they devoured an enormous quantity of fish, and even occasionally their own species, for small ichthyosauri have been met with, in the inclosed remains of the large ones.

Freaks of the Animal Kingdom.

With these terrible rulers of the ancient seas lived the plesiosauri, reptiles equally strange, and which Cuvier considered as the most singular races of the early world. They were remarkable for their turtle-like fins, and especially for the thinness and extreme length of their serpent-like necks. The arrangement of the skeleton in the plesiosaurus indicates that it swam ordinarily on the surface of the waves, curving back its long flexible neck like a swan, and darting forward with it from time to time in order to seize the fish which approached it. Their paws, similar to those of the sea turtles, show that the plesiosauri, like these reptiles, sometimes issued from the sea and sought refuge amid the plants, in order to evade their dangerous enemies, which were beyond all doubt the ichthyosauri.

If any of the animals which the remote periods of the globe present to our notice are to be looked upon as monsters, we submit that in this respect the first place is due to the pterodactyli, which remind one of the ancient dragons of legendary tradition. Their structure is so strange that one does not really know where to place them; they were alternately looked upon as birds, mammals, and reptiles. De Blainville, embarrassed, as indeed all the learned world were, formed a separate class for them in the animal kingdom. The aspect of the pterodactyl was necessarily very strange. When naturalists tried to restore their frames, the figures they produced were more like the offspring of some diseased imagination than realities. They were really reptiles furnished with large wings, and resembled enormous bats, having a very pointed head supported on a slender neck.



FIERCE COMBAT BETWEEN THE MEGALOSAURUS AND IGUANODON.

At the period in the history of the world when the ocean swarmed with such monsters as the ichthyosaurus, the land was tenanted by huge crocodile-like lizards. These were reptiles provided with feet; while those inhabiting the sea were partly like fishes, and had paddles to enable them to swim. The largest of the land species was the iguanodon, so called because it resembled in structure, and in the character of its teeth, the iguana, a lizard common in the tropical parts of America. The iguana of the present day only grows to the length of four or five feet, while the iguanodon of former ages reached astonishing dimensions. The small horn on its nose gave it a strange, dragon-like aspect; but, notwithstanding its enormous size and formidable look, it was probably a harmless creature, like its modern relative, feeding only on vegetable substances.

A Terrible Monster.

The megalosaurus, or "great lizard," was, on the other hand, a dreadful carnivorous monster, almost as huge as the iguanodon, but far more terrible; for its immense jaws look as if they could have crushed through a bar of iron, and its formidable rows of teeth were specially adapted for cutting and tearing flesh: for some were arranged like those of a saw, while others were curved backward like a sabre, and sharp all along the inner edge, so that when an animal was seized by them it could not possibly escape. The body of the megalosaurus was covered with strong plates like armor, and its legs were longer in proportion to its size than those of other lizards. As these monsters were not sluggish like the crocodile and alligator, but, from their flexible, lizard-like structure, probably swift and sudden in their motions, the destruction of animal life by such must have been immense; and, indeed, their voracity may have been one cause of their extinction, for when other food failed them they may have attacked each other, the large herbivorous animals, such as the mastodon and mammoth, not being then in existence. From the plants preserved in the same rocks which contain the remains of these creatures, we know that they must have lived in a tropical climate, for the vegetation chiefly consists of tree-ferns and palms, such as only grow in hot countries.

The megalosaurus received its name from its gigantic size, although the size is, in some respects, the character of least importance. The tribe of lizards, one of the most important of the existing reptilian groups, forms a link in the chain by which the animal we are now describing was connected with known forms; but, although analogies unquestionably exist between the lizard and the megalosaurus, and also between this animal and the crocodiles, there yet remain marked and peculiar features separating it from both. It is now considered as one of an extinct family,

A MASSIVE ANTEDEILUVIAN ANIMAL—THE MEGALOSAURUS.



pre-eminently remarkable for the great height at which all the species stood above the ground in proportion to all other reptiles; and the height is indicated not less by the actual size of the bones of the extremities, than by the provision made in the skeleton to resist the pressure of an enormous weight.

The megalosaurus was a gigantic carnivorous land reptile, its body being of enormous size. It was clothed in scaly armor and stood with its whole body considerably above the ground, in bulk and general appearance rather resembling the hippopotamus than the gigantic alligators of the present day. It was provided with a true reptilian tail, the length of which was considerable, although not nearly so great in proportion as that of existing crocodiles and alligators. The head was terminated by a straight, narrow, and long snout, not tapering, but compressed laterally. The teeth were of moderate size. They formed, however, strong and powerful cutting instruments, for the fore part was sharp and jagged, and the hind part much thicker and blunt, while one set succeeded another.

An Ingenious Arrangement.

The vertebræ are somewhat peculiar in form, and present nearly flat surfaces to one another; but it is chiefly one group, consisting of five, firmly cemented together into a solid mass, and distributing the weight of the body upon the hinder extremities, that forms an exception to the ordinary reptilian character. Except the megalosaurus, and the two or three extinct species now grouped with it, and belonging to the same period, no reptile has more than two bones cemented together for this purpose; and this is found sufficient, because much of the weight is supported directly upon the ground either by the body or tail of the animal. On the other hand, all the heavy land quadrupeds exhibit great strength and solidity in this part. It is interesting to find the long and powerful extremities of this monstrous reptile thus combined with a structure altogether different from that of other reptiles, but manifestly related to its habits. The vertebræ of the megalosaurus thus united are not in a straight line, but describe a gentle curve with the concavity downwards.

The bones of the extremities are long, large, and hollow, resembling in this the corresponding bones of land quadrupeds. They exhibit, however, a mixture of the characters observed in the crocodile and in some lizards. They are so large, compared with the bones of animals most nearly allied, that, if the same proportions had held throughout, the megalosaurus might be compared with a crocodile sixty or seventy feet long, did such a monster exist; but the whole structure of the animal indicates considerably greater bulk and height in proportion to length than is seen in other rep-

THE CURIOUS PTERODACTYLE, OR WING-FINGERED BIRD.



tiles. The trunk was broad and deep, the tail comparatively short, and the limbs unusually long. We have no means of deciding in what manner the tail was carried.

A Peculiar Skeleton.

This gigantic land reptile was accompanied by another, and still more oddly constituted animal, connecting the reptiles with birds in a manner not less remarkable than that by which the megalosaurus unites them with quadrupeds. The pterodactyl is a true flying reptile. It exhibits, however, in the various parts of its skeleton such strange resemblances to other and very widely separated groups, that it was successively described as a bird and a bat, before it was acknowledged according to its true analogies; and this not without some ground, since the mistake arose from the presence of peculiarities of structure considered in each case as characteristic of the two great classes of vertebrata to which it was referred. It is, perhaps, the most extraordinary of all the beings of whose former existence the study of fossils has made us aware, and is that which if living would appear most unlike any thing that exists in the known world. In the external form of the body the pterodactyli probably resemble the bats or vampires; and some of the species attain the size of a cormorant, although others were not larger than a snipe. The resemblance, however, to the bat tribe, was limited to the form of the body, for the head was totally different, the snout being enormously elongated, and the eyes exceedingly large; while the organs of flight or wings were even more powerful in proportion, and the legs were probably capable of being used in the water, assisting the animal to swim. Let us now consider a little more in detail some of the peculiarities of structure of this strange monster.

In the first place, the skull, far from resembling that of a bat or bird, resembles in its general proportions, and even in some points of detail, that of the crocodiles; and the reptilian analogies are completely preserved in the position and small size of the cranium, and in the enormous length of the snout. The lower jaw is not less reptilian, and is provided, as well as the upper jaw, with a long row of powerful teeth implanted in sockets, and successively replaced as they were worn and lost. The number of these teeth was about sixty; they were conical like those of the crocodile, but larger compared with the size of the jaw. The whole of the other proportions of the head indicate a creature of great strength, capable of darting down upon fishes or preying upon the smaller land animals.

A Strangely Formed Creature.

The neck of the pterodactyl, although it contains only the usual number of vertebræ (seven,) must have been of great length, and well fitted to

support and move the powerful head just described, but an unusual provision is observable in the neck, assisting to give additional strength to the head, a set of bony tendons running along the vertebræ for this purpose. The length of the neck corresponds with what we see in birds, and indicates a perfect adaptation of the animal for rapid and long-continued flight. In one specimen the head is thrown back so far, that the base of the skull almost touches the tail, without the bones appearing to be in an unnatural position. But it is chiefly in the bones of the extremity, by means of which the animal was enabled to fly, at the same time retaining the power of walking and in all probability of swimming, that we find the most singular of the mechanical contrivances, and observe a structure different from that of any other species, either living or extinct.

A Bird and Reptile Combined.

The bones which support the wings of a bird exhibit, in spite of great external difference, a good deal of similarity to the bones of the fore extremities of quadrupeds, and even reptiles; and it might have been expected, that, in adapting a species of either of these latter classes for flight, and enabling it to live chiefly in the air, similar modifications would have been adhered to. But the fact is not so. The wings of a bird owe a great part of their efficacy to the feathers with which they are covered; and as it did not enter into the plan of nature to provide quadrupeds or reptiles with these appendages, other mechanical contrivances are resorted to by which the power of flight is obtained, and the common integument preserved in the bat and pterodactyl. In bats, which are flying quadrupeds, this modification consists in the extraordinary development of all the fingers, upon which skin is stretched like the silk on the rods of an umbrella; and this skin extends not merely between the elongated fingers, but also from the last finger to the legs and feet, and so to the tail. The thumb is partially free, and serves as a hook for suspending the animal.

There is no really flying reptile now existing, but in one species, which is able to support itself for a short time in the air; there is a very imperfect flying apparatus, which chiefly acts as a parachute, supporting the animal in its long leaps. This consists of an expansion of the skin over a series of false ribs extending horizontally from the back bone. In the pterodactyl, however, which is evidently and expressly contrived for flight a very singular contrivance is introduced, and it is one which seems to have ensured to the animal the power of walking and swimming, as well as flying.

In order to effect this, the bones of the fore extremity, so far as regards the shoulder and arm-bones, the wrist and the hand, scarcely differ from

the ordinary proportions of those bones in lizards, and correspond with the dimensions of the hinder extremity, so that up to this point there is no peculiar adaptation for flying. On examining the bones of the fingers, however, we find that the number of joints in that which corresponds to the little finger is increased to five, and each joint is enormously lengthened. To the whole of the little finger, thus produced till it has become longer than the body and neck together, a membranous wing was attached, which was also fastened to the rest of the arm, to the body, and to a portion of the hinder extremity. When, therefore, the arm was extended, the wing was not necessarily expanded, and only became so on the little finger being also stretched out so as to be at right angles to the arm; and the membrane was then nearly surrounded on four sides by bone. By this contrivance the necessity of employing the whole arm in the mechanism of flying as in the bird, or the whole hand as in the bat, was done away with, and the flying apparatus being confined to one finger, the arms and hands could be readily and conveniently made use of like the corresponding extremities of other animals.

A Creature with Remarkable Agility.

The great peculiarity, then, in the pterodactyl, with regard to the organs of locomotion, is the freedom with which the arms and legs could act when the wings were not in use—and this extends even to the structure of the toes, which in the bat form only a single hook, but in the pterodactyl were free, and would allow the animal to stand firmly on the ground, to walk about like a bird, to perch on a tree, to climb rocks and cliffs, and possibly also to swim in the ocean.

We have, therefore, in this singular genus an animal which, in all points of bony structure, from the teeth to the extremity of the nails, presents the characteristics of a reptile, being even perhaps covered with scaly armor, and which was also a true reptile in the important peculiarities of the structure of the heart and circulating organs. But it was at the same time provided with the means of flying; its wings, when not in use, might be folded back like those of a bird; and it could suspend itself, by claws attached to the fingers, from the branches of a tree. Its usual position, when not in motion or suspended, would probably be standing on its hind feet, with its neck curved backwards, lest the weight of the enormous head should disturb the equilibrium of the animal.

Reverting now to the megalosaurus, its gigantic companion received the name of iguanodon. This has already been mentioned, but we give here a full description of this marvelous creature. It is known to us by the teeth and a considerable part of the skeleton. The teeth of the igu-

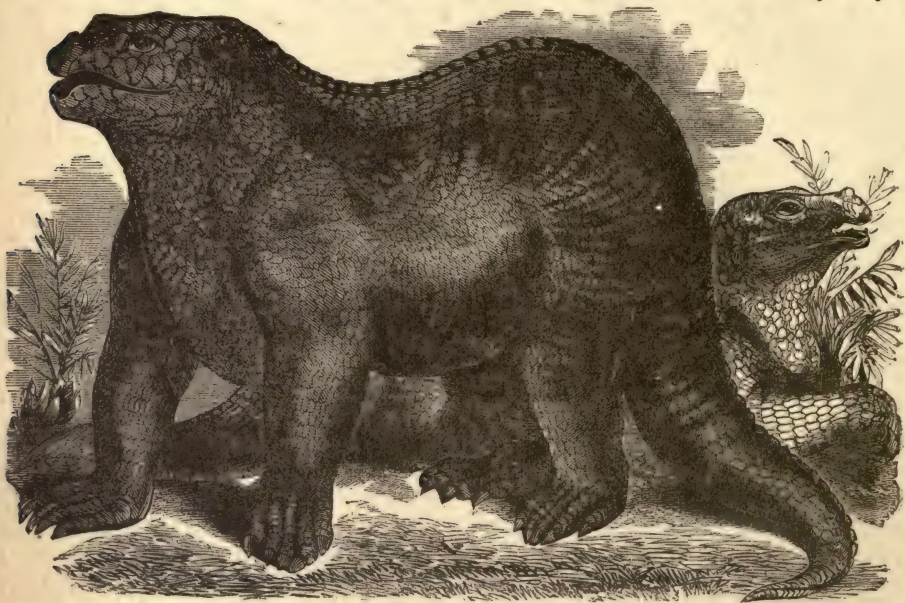
anodon are partly composed of bone, gradually becoming softer from the edge inwards, and partly of enamel, by which they are surrounded; the result of this contrivance being the formation of a slant surface of the crown of the tooth, and therefore of a sharp cutting edge. While young, the tooth presents a sharp edge, and is lancet-shaped as it grows further out from the jaw, and is then a powerful instrument, well adapted to separate tough vegetable fibres; while in its most advanced state it ceases to be adapted to this purpose, but is strong and flat, and at the same time uneven, the pulp of the tooth projecting from the surface, which is worn so as to be nearly horizontal, and forming a transverse ridge. The teeth therefore begin by being incisors, and in the course of time, as they become worn, they pass into the condition of grinders—a curious change, providing for the animal a perpetual supply of teeth of all kinds, some enabling it to nip off tough vegetable food, and others helping to grind that food properly before it is committed to the stomach.

A Bony Structure of Great Strength.

The vertebral column of the iguanodon is on a scale commensurate with the vast bulk of the animal. The vertebræ themselves have nearly flat surfaces, and are large and somewhat wedge-shaped like those of the crocodile. The neck is not known, since no vertebræ have yet been found belonging to this part. The sarcum, or that part of the back-bone, cemented together to distribute the weight of the body on the hinder extremities, includes five vertebræ, as in the megalosaurus; and in one specimen this continuous solid ridge of bone measures seventeen inches in length, and its breadth, though only eight inches at the fore part, becomes as much as thirteen inches towards the hinder part. The magnitude, both in diameter and length, of the thigh and leg bones, corresponds well with the large portion of the spine thus grasped, as it were, by the bones of the pelvis, and strongly points to the terrestrial habits of the animal. The total length of the extremities seems, in some cases, to have exceeded eight or even nine feet, and the bones of the foot are gigantic even beyond the proportions thus indicated, since one of the separate bones measures thirty inches in length, and the last joint of the toe, to which a claw was attached, is five inches and a half long. There was thus an ample base for the vast column supporting the body.

The tail of the iguanodon was probably very much shorter in proportion than that of crocodiles, and was very dissimilar. It must, notwithstanding, have been large, and flattened laterally, being of considerable breadth in the vertical direction near its attachment to the body. The ribs were very large, broad, and long.

While the bones or the extremities were perhaps six or eight times larger than those of the most gigantic alligator, the whole length of the iguanodon is not likely to have exceeded thirty feet. Even then, however, allowing about three feet for the head, and assuming that the neck was short, and that the tail was about thirteen feet long, which it is calculated would be the extreme size, we still have a length of twelve feet for the body, and this is much more than is seen in the trunk of any living animal. The body being of this length, and perhaps of more than corresponding bulk, and lifted many feet from the ground, reaching perhaps to the height of twelve or fifteen feet, must have indeed been sufficiently monstrous, and departed widely enough from any known animal to justify



THE PONDEROUS IGUANODON.

the accounts that have been given of its strange and marvelous proportions.

It is difficult to confine the imagination within due bounds when we endeavor to recall scenes enacted during the earlier periods of the earth's history, and to picture these past events without running into extravagance, and without overstepping the limits of simplicity and probability, which should always characterize natural history. There is, however, no need of exaggeration in depicting the wonders of those ancient periods. Let us imagine ourselves placed on a projecting headland or hill of

mountain limestone, anciently, as now forming a prominent and picturesque object, but commanding a view of the open sea, which then covered the greater part of our island. Placed in imagination in this commanding position, let us endeavor to recall the scenes once enacted near some tract of low flat land—a sandy shore of the oolitic period—on which, at a distance, a few solitary palm trees stand out against the blue sky, but which is backed by a more luxuriant growth of pines and ferns, extending towards the interior, and crowning the tops of distant high ground.

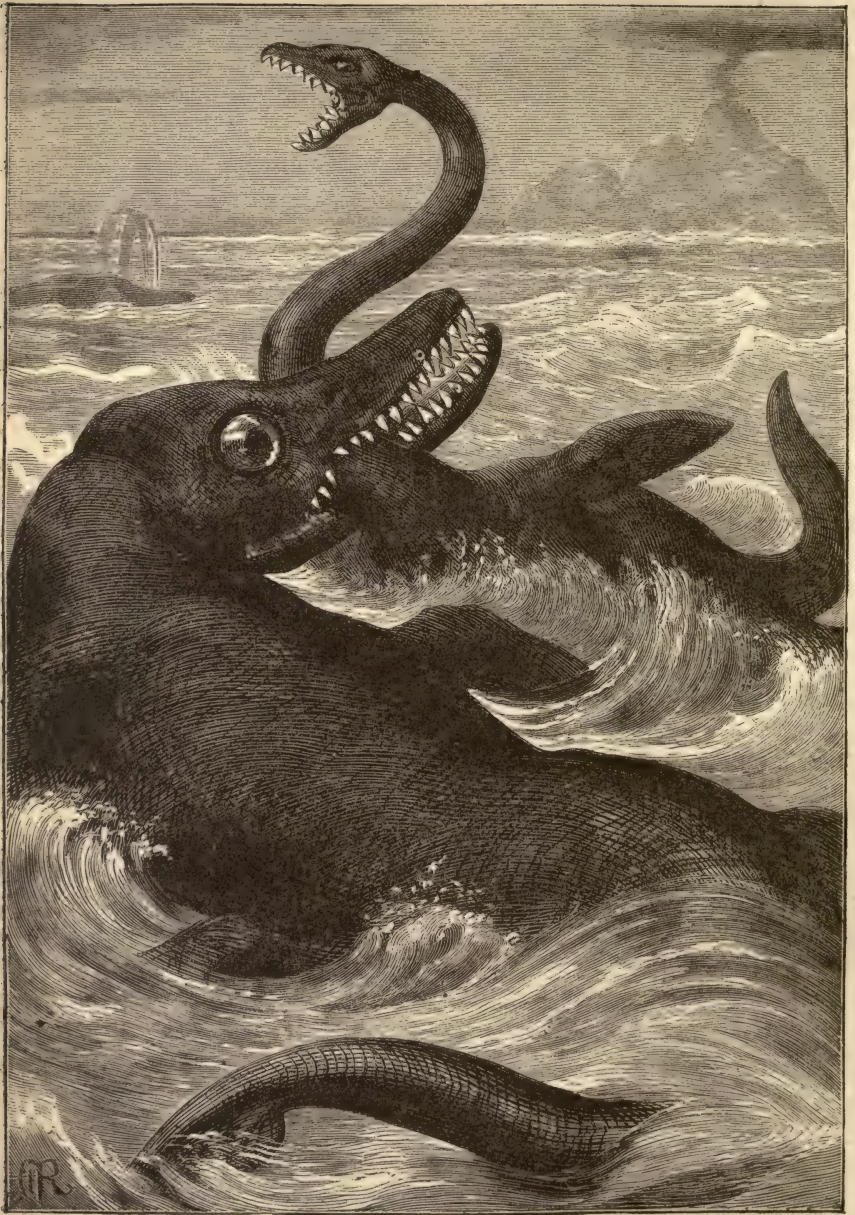
The first object that attracts attention might be one of the crocodilian animals with its long slender snout, and with extremities admirably adapted for swimming, combining those peculiarities of structure which distinguish the *teleosaurus*. This animal might be seen moving slowly, and not without difficulty, towards the water, but when there, darting abruptly along, pursuing and devouring the small fishes that swarmed about the shallows; these fishes, sluggish in their nature, and chiefly feeding on the molluscs which live near the shore, falling a ready and abundant prey. Many other crocodilian monsters, of similar habits, but more or less adapted for a marine life, might also have been seen wandering about.

Leviathans of the Antediluvian Seas.

While, however, this was going on in the near vicinity of land, our supposed position would enable us to watch also the open sea at a little distance. Here we could not fail being struck with that gigantic reptile, the *cetiosaurus*, easily recognized by the dark outline of its huge head raised partly above the surface to enable the animal to breathe, while at the distance of some twenty yards from this would be seen its great fish-like tail. Could our power of vision enable us to see beneath the surface, there might also be observed those singular webbed feet, and enormous toes armed with long powerful claws, which so strikingly characterize this creature.

But another of the monsters of the deep demands our notice—a truly marine reptile—gigantic in its proportions, admirably adapted for rapid motion, and combining some of the terrestrial and crocodilian peculiarities of the long-necked *plesiosaurus*, with the compact proportions of the great fish-lizard. Its huge crocodilian head contrasts strongly with the porpoise-like body, which is attached without any intervening neck; and its powerful elongated extremities make up for the absence of a vertical tail-fin. The sharks, which were still abundant and powerful, and even the *ichthyosaurus* itself, could scarcely have escaped from these terrible enemies.

Having thus obtained glimpses of the sea and its inhabitants, let us



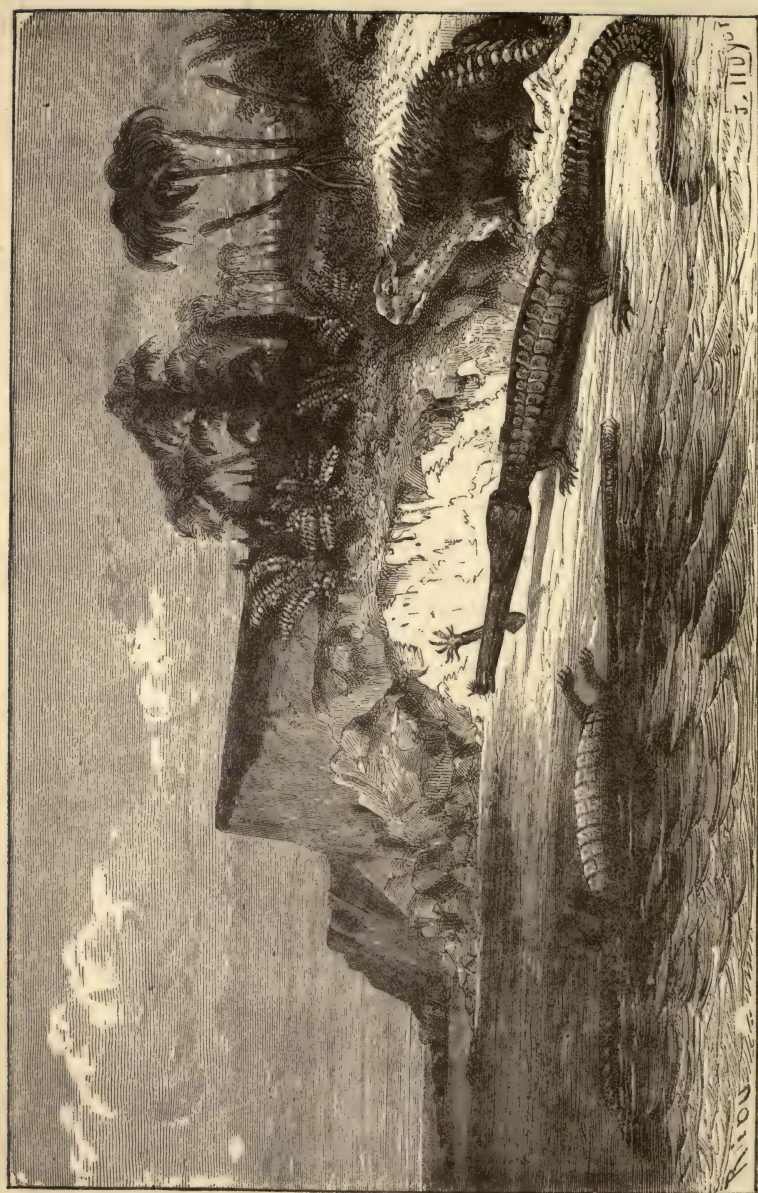
THE ICHTHYOSAURUS AND PLESIOSAURUS IN MORTAL COMBAT.

next turn our attention to the adjacent land. The long-snouted and other crocodiles, which have gorged themselves with fish in the shallow water, now sleep half buried in the muddy and naked plains on shore. Some of them, eighteen or twenty feet long, advance on land with difficulty, their extremities being far better adapted to swimming than walking. Presently a noise is heard, and a huge animal advances, whose true nature and habits we are at first at a loss to understand. In its general proportions it is far longer and also taller than the largest elephant; its body hangs down near the ground, but its legs are like the trunks of great forest trees, and its feet form an ample base for the vast columns which press upon them. Instead of long tusks, large grinding teeth, and a trunk like that of the elephant, this animal has an exceedingly elongated and narrow snout, armed throughout with ranges of sharp and strong knife-like teeth. The monster approaches, and trodden down with one of its feet, armed with powerful claws, or caught between its long and narrow jaws, our crocodile is devoured in an instant.

Insects of Marvelous Brilliancy.

But there is yet another scene for us to contemplate. Still remaining at no great distance from the shore, but advancing inland towards the forest, let us watch the golden beetles, and the beautiful dragon-flies and other insects as they flit past in all the brilliancy and cheerfulness of luxuriant and untamed nature. The lofty forest trees, perhaps not much unlike some existing but southern pines, are woven together with thick underwood; and the open country, where it is not wooded, is brown with numerous ferns, still the preponderating vegetation, and distributed in extensive groups. Here and there a tree is seen, overturned and lying at its length upon the ground, preserving its shape, although thoroughly rotten, and serving as the retreat of the scorpion, the centipede and many beetles. A few quadrupeds, not larger than rats, are distinguished at intervals, timid even in the absence of danger, and scarcely appearing from their shelter without great precaution.

A strangely formed animal, however, is perceived running along upon the ground: its general appearance in motion is that of a bird, but its body and long neck, its head and wings, are not covered with feathers, but are either quite bare, or perhaps resplendent with glittering scales; its proportions are quite unlike those of any known animal; its head is enormously long, and like that of a crocodile; its neck long and outstretched, or thrown back on the body; its fore extremities have four free toes, but the fifth toe folded down on the body; its hind legs are short, and its feet perhaps webbed. This animal, running along upon the



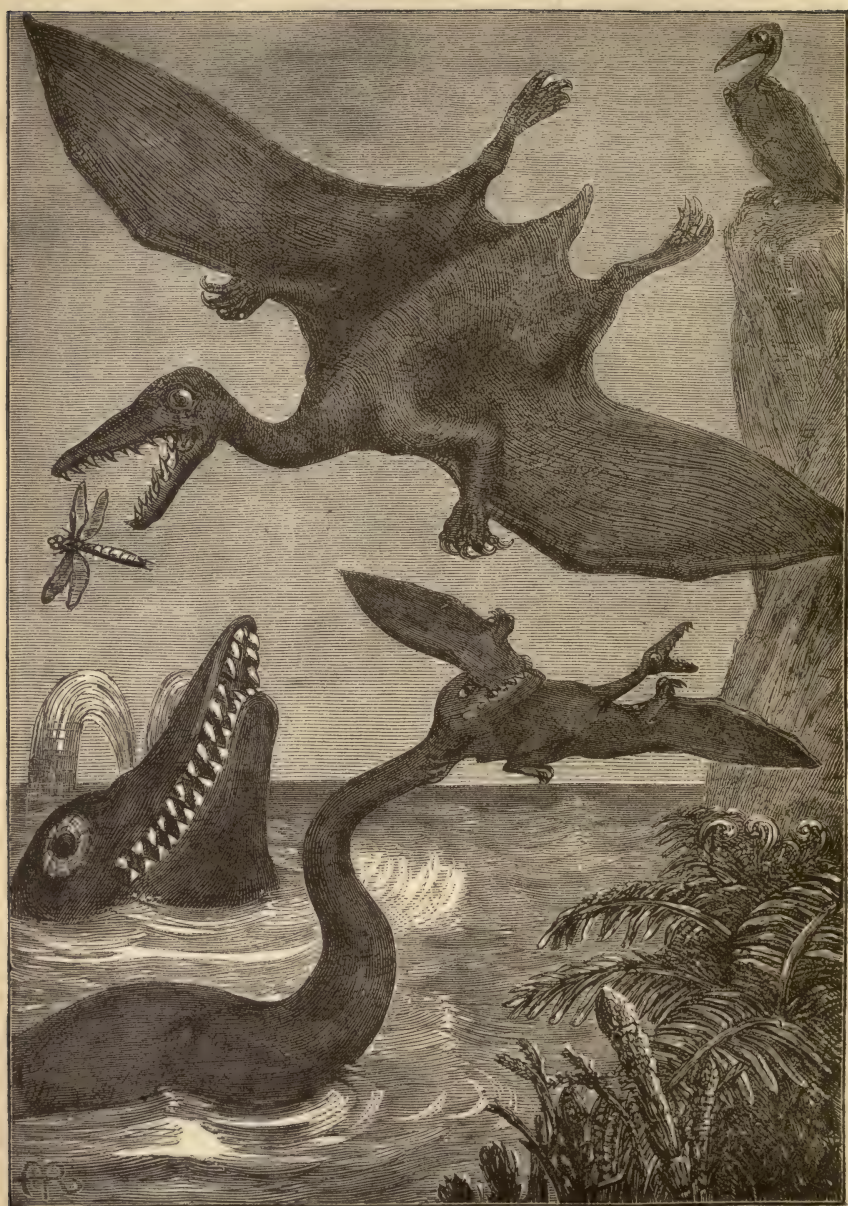
SINGULAR REPTILES OF THE OOLITIC PERIOD,

ground, pursues and devours the little quadruped we have been watching, and then perhaps darts off towards the sea to feed upon the fishes, which its peculiar powers would enable it to take, either pouncing upon and so transfixing the victim, or even occasionally diving in search of prey.

The Flying Lizard.

But we have not yet noticed the strangest phenomenon. This mailed reptile, four of its fingers still free, but the fifth opened out, and by a connecting membrane forming a wing of very large size, rises into the air, and flits about or hovers over-head, realizing and even surpassing, in the conditions of its existence, the wildest mythological accounts of flying dragons which we read of, or those representations which we see pictured by the pencil of the Chinese. Of all the strange creatures that have ever appeared in the world, perhaps the strangest was this pterodactyl, or wing-fingered reptile. The remains of one have been found whose wings had a spread of twenty-seven feet, thus exceeding in size the largest condor of the Andes. But it could fly in the air or walk on the ground, climb trees and rocks by means of its strong claws, and most likely it could swim in the water. Its wings consisted of a membrane extending from what we must call its fingers all along the body to the hinder limbs, and from the size and form of these latter it is evident that it must have walked or perched in the manner of a bird, to which its long neck also gave some resemblance. But it was a flying dragon, and had jaws like a crocodile's, armed with sharp-pointed teeth; and its eyes were very large, probably adapted for seeing at night. From its remains being found together with those of dragon-flies and beetles, it appears to have lived mostly on insects, while the larger kind are supposed to have eaten fish, which they may have seized like the sea-gull whilst flying over the water. The pterodactyl has utterly passed away with the age in which it lived, and there is nothing like it now in nature. In its time, it seems to have filled the same place in the natural economy that bats do now. But the pterodactyl was a reptile, a flying lizard, while the bats belong to quite a different order of animals.

Modified, no doubt, by considerable and even important changes in matters of detail, but still remaining in all essential points the same, the picture thus given may be looked on as neither false nor exaggerated, however imperfect, and as, to a certain extent, characterizing the whole of the long period during which the oolites were being deposited. From time to time, in various places during this period, coral reefs were formed, mud-banks accumulated, and occasionally a considerable quantity of sand was also brought in; and thus there went on a series of changes,



THE FLYING DRAGON.

resulting in the formation of many important beds of limestone and much clay, along a coast-line gradually advancing eastwards, and probably undergoing numerous alterations of level.

Surrounded with a constantly renewed vegetation, in an atmosphere and with climatic conditions probably admirably adapted to its habits, there existed another monstrous animal, more unweildy even than the megalosaurus and treading down whole forests in its advance, organized so as to clear away a portion, at least, of the results of a rapid growth of vegetable matter. These animals must have been very numerous where their remains have been found; they have furnished sufficient material to enable us to complete, in imagination, their singular forms.

A Colossus of the Antediluvian Age.

The dinotherium is the most remarkable of the ancient animals, and the largest which has ever lived. For a long time we possessed very imperfect portions of its skeleton, and Cuvier was induced erroneously to place it among the tapirs. The discovery of a lower jaw nearly perfect, armed with defensive tusks descending from its under side, demonstrated that this hitherto mysterious animal was the type of a genus altogether new and singular. Nevertheless, as it was known that there were some animals of the ancient world in which both jaws were armed, it was thought for some time that such was the case with the dinotherium. But in 1836 a head, nearly entire, was found, and this fine fragment was carried to Paris, and exposed to public view. It was nearly a yard and a half long. The defences, it was found, were enormous, and were carried at the extremity of the lower jaw-bone, and much curved inwards. The molar teeth were in many respects analogous to those of the tapir, and the great holes under the orbits, joined to the form of the nasal bone, rendered the existence of a proboscis or trunk very probable.

This colossus of the ancient world, respecting which so much has been said, somewhat approaches the mastodon: it seems to announce the elephant, but its dimensions were vastly greater than the living elephants, superior even to that of the mastodon and the mammoth, both fossil elephants. From its kind of life, and frugal habits this monster scarcely merited the formidable name imposed on it by naturalists, of "terrible animal." Its size was, no doubt, frightful enough, but its habits seem to have been harmless. It is supposed to have inhabited the fresh water lakes, or marshes and the mouths of great rivers, by preference. Herbivorous like the elephant, it employed its proboscis probably in seizing the herbage suspended over the waters, or floating on their surface. We know that the elephants are very partial to the roots of vegetables growing in



THE IMMENSE DINOTHERIUM.

flooded plains. The dinotherium appears to have been similarly organized, and probably sought to satisfy the same tastes. With the powerful mattock which Nature had supplied him for penetrating the soil, he would be able to tear from the bed of the river or lake nourishing roots, for which the mode of articulation in the jaws, and the powerful muscles intended to move them, as well as the large surface of the teeth, so well calculated for grinding, were evidently intended.

The more ancient of the secondary rocks have interested geologists on account of the innumerable remains of shells which they contain. At the time when these strata were being deposited lived one of the most extraordinary reptiles of which we have any knowledge. It was a kind



AN EXTRAORDINARY REPTILE—THE LABYRINTHODON.

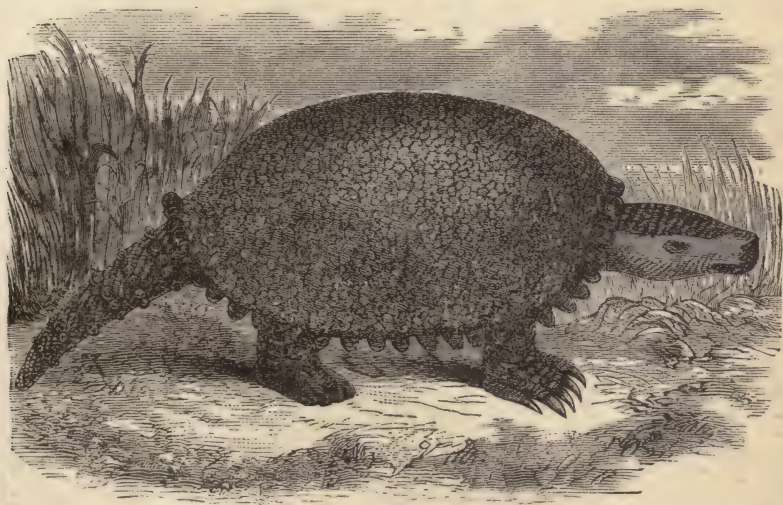
of monster toad, so enormous as to equal an ox in size, the teeth of which, resembling the windings of a maze, have procured for it the name of labyrinthodon. The rocks of this ancient epoch have taught us something even of the anatomical details of this animal, having preserved the impressions of its footsteps. On the same beds have been observed the prints of three-toed feet, considered by some geologists as traces of the first birds on our globe.

The armadillo, ant-eater and pangolins, are the living examples of an ancient order of creatures which were characterized by largely developed claws at the extremities of the toes. The order seems thus to establish



A GROUP OF CURIOUS HAND-ANIMALS.

itself as a zoological link in the chain between the hoofed animals and those armed with claws. All these animals belonged to the American continent. The glyptodon, which appears during this period, belonged to the family of armadillos, and their most remarkable feature was the presence of a hard scaly shell composed of numerous scales, which cover the entire upper surface of the animal from the head to the tail; in short, a mammiferous animal, which appears to have been enclosed in a shell like the turtles: it resembles in many respects the ant-eater, and had sixteen teeth in each jaw. These teeth were channeled with two broad and deep lines, which divided the surface of the molars into three parts. The hind feet were broad and massive, and evidently designed to support a vast incumbent mass; it presented phalanges armed with nails or claws,



THE ARMADILLO OF THE ANCIENT WORLD.

short, thick and depressed. The animal was enveloped in, and protected by, a solid case, composed of plates which, seen from beneath, appeared to be hexagonal in shape. The glyptodon had a near relative which is represented in the accompanying engraving. This armadillo of the early world was supposed to have been a different member of the same species, the chief difference in the two animals being in the structure of the tail, which is massive in the first, and in the other is composed of half a score of rings. In other respects the structure and habits are the same, both being herbivorous and feeding on roots and other vegetable products.

Another family of reptiles appears in this epoch, and their relics show that they had a very singular construction. This is the teleosaurus, which

recent investigations permit us to reconstruct. The teleosaurus allows us to form a pretty exact idea of the crocodiles of the ancient seas—those curiassed reptiles, which the German geologist Cotta describes as the great barons of the kingdom of Neptune, armed to the teeth and clothed in an impenetrable panoply; the true filibusters of the primitive seas. The teleosaurus has an anatomical resemblance to some of the present reptiles of India. They inhabited the banks of rivers, perhaps the sea itself; they were longer, more slender, and more active than the living species; they were about thirty feet in length, of which the head was from three to four feet, with their enormous jaws well defended beyond the ears, sometimes with an opening of six feet, through which they could engulf, in the depths of their enormous throat, animals of the size of an ox. In the river Ganges, in India, there is a huge reptile called the gavia, distinguished from the Egyptian crocodile by the extraordinary shape of head and jaws: there is no other living species of crocodile like it; but Britain once possessed a crocodile resembling that of the Ganges, and of even larger dimensions. The teleosaurus was a reptile of that remote period that preceded the age of the great elephants and tigers. Its teeth were more numerous, and set closer together, than those of the Egyptian crocodile; and it was covered with plates on its under side as well as on its back. Though it was longer and more slender than the crocodile of the Ganges, and the vertebræ of its back-bone were united by flat plates instead of a ball and socket, it resembled it more than any other animal.

An Oddity of the Animal Creation.

In those ages, so long passed away, when such monstrous creatures lurked amongst the reed-like plants of the rivers, and the forests of strange trees were haunted by reptiles of still more vast dimensions, how different must the aspect of the country have been from what it is now!

The megatherium, or animal of Paraguay, as it was called, is, at first view, the oddest and most extraordinary being we have yet had under consideration, where all have been strange, fantastic and formidable. The animal creation still goes on as if—

Nature made them and then broke the die.

Towards the close of the last century, an almost perfect skeleton of this gigantic animal was dug up, at the depth of one hundred feet, in a bed of clay on the banks of the river Luxon, near Buenos Ayres. This skeleton was sent to the museum at Madrid, where it now remains. The megatherium was armed with claws of enormous length and power, its whole frame possessing an extreme degree of solidity. With a head and neck like those of the sloth, its legs and feet exhibit the character of the



THE FAMOUS ANTEDILUVIAN CROCODILE.

armadillo and the anteater. Some specimens of the animal give the measurement of five feet across the haunches, and the thigh bone was nearly three times as thick as that of the elephant. The spinal marrow must have been a foot in diameter, and the tail, at the part nearest the body, twice as large, or six feet in circumference. The girth of the body was fourteen feet and a half, and the length eighteen feet. The teeth were admirably adapted for cutting vegetable substances, and the general structure and strength of the frame for tearing up the ground in search of roots, wrenching off the branches of trees, and uprooting their trunks, on which it principally fed.



THE GIGANTIC MEGATHERIUM.

Heavily constructed, and ponderously accoutred, it could neither run, nor leap, nor climb. It was an unwieldy monster, and all its movement must have been necessarily slow. But what need of rapid locomotion to an animal whose occupation, of digging roots for food, was almost stationary? And what need of speed, for flight from foes, to a creature which, by a single pass of his paw, or lash of his tail, could in an instant have demolished the cougar or crocodile? Where was the enemy that would dare encounter this leviathan of the pampas? Or in what more

powerful creature can we find the cause that has effected the extirpation of his race? His entire frame was an apparatus of colossal mechanism, adapted exactly to the work it had to do—strong and ponderous in proportion as this work was heavy, and calculated to be the vehicle of life and enjoyment to a gigantic race of quadrupeds, which, though they are extinct, have in their fossil bones left behind them imperishable monuments of the consummate skill with which they were constructed.

A Gigantic Sloth.

If we glance at the skeleton of this animal, it is impossible to avoid being struck with its unusually heavy form, at once awkward and fantastic in all its parts. It is allied to the sloths, which Buffon tells us are of all the animal creation those which have received the most vicious organization—beings to which nature has forbid all enjoyment: which have only been created for hardships and misery. An attentive examination of the animal of Paraguay shows that its organization cannot be considered so odd or awkward when viewed in connection with its kind of life and individual habits. The special organization which renders the movements of the sloths so heavy, and apparently so painful on the level ground, gives them, on the other hand, marvelous assistance when they live in trees, whose leaves form their exclusive food. In the same manner, if we consider that the megatherium was created to burrow in the earth and feed upon the roots of trees and shrubs, every organ of its heavy frame would appear to be perfectly appropriate to its kind of life and well adapted to the special purpose which has been assigned to it. We ought to place the megatherium between the sloths and ant-eaters. Like the first, it fed exclusively on the leaves of trees; like the second, it burrowed deep in the soil, finding there at once nourishment and shelter. It was large as an elephant or rhinoceros of the largest species. The remains collected were found in the river Luxon, which runs through the great plains to the south of Buenos Ayres. A succession of three unusually dry seasons had left the waters so low as to expose the skeleton to view as it stood upright in the mud in the bed of the river. Further inquiries led to the discovery of two other complete skeletons, not far from the spot where the first had been found; and not far from them an immense shell, the bones connected with which crumbled to pieces after exposure to the air. It is probable that, like the armadillo, the megatherium employed the tail to support the enormous weight of its body: it was also a formidable defensive arm when used as it is by crocodiles. The hind feet were about three feet long and one foot broad. They formed a powerful implement for excavating the earth at great depths where the roots of

vegetables penetrated. Solidly supported by the two hind feet and the tail, and in advance by one of the fore feet, the animal employed the fore foot at liberty in hollowing out the earth or tearing up the roots of trees; the toes of the fore feet were for this purpose furnished with large and powerful talons, which lay at an oblique angle in relation to the soil, much like the burrowing talons of the mole. The anatomical organization denotes heavy, slow, and powerful locomotion, but solid and admirable combinations for supporting the weight of an enormous creature; a sort of excavating machine, nearly immovable, and of incalculable power for its own purposes.

The skeleton of an animal similar to the megatherium has been found in



SKELETON OF THE MEGATHERIUM.

our own country. In consequence of some hints given by Washington, Thomas Jefferson discovered in a cavern of Western Virginia some bones which he declared to be the remains of some carnivorous animal. These bones Mr. Jefferson believed to be similar to those of the lion. Cuvier saw at once the true analogies of the animal. The bones were the remains of a species of gigantic sloth, the complete skeleton of which was subsequently discovered in the Mississippi, in a state of preservation so complete that the cartilages still adhering to the bones were not decomposed. Jefferson called this species the *megalonyx*. It partook of the characteristics of the sloth; its size was that of the largest ox; the muzzle was

pointed; the jaws armed with cylindrical teeth; the anterior members much longer than the posterior; two great toes, short, armed with long and very powerful claws; the index finger more slender, furnished with a claw less powerful also; the tail strong and solid: such were the salient points of the organization of the megalonyx, whose form was a little lighter than the megatherium.

Singular Habits of Pre-historic Animals.

The habits of these megatheroid animals, says Mr. Darwin, were a complete puzzle to naturalists, until Professor Owen, with remarkable ingenuity, solved the problem. The teeth indicate that they lived on vegetable food, and probably on the leaves and small twigs of trees. Their ponderous forms and great curved claws seem so little formed for locomotion, that some naturalists have actually believed that, like the sloths, to which they are intimately related, they subsisted by climbing, back downwards, on trees, and feeding on the leaves. It was a bold, not to say preposterous idea, to conceive even antediluvian trees, with branches strong enough to bear animals as large as elephants. Professor Owen, with far more probability, believes that, instead of climbing on the trees, they pulled the branches down to them and tore the smaller ones up by the roots, and so fed on their leaves. The colossal breadth and weight of their hind quarters, which can hardly be imagined without being seen, become, on this view, of obvious service instead of being an incumbrance; their apparent clumsiness disappears. With their great tails and huge heels firmly fixed like a tripod in the ground, they could freely exert the full force of their powerful arms and great claws. One species was furnished with a long tongue, capable of great extension like that of the giraffe, which, by a beautiful provision of nature, thus reaches its leafy food.

An Extraordinary Neck.

It has already been intimated that the destruction of animal life in the early ages was partially due to the warfare waged by one species upon another. This is illustrated strikingly by two monsters to which we have previously referred. The plesiosaurus is the name given to one of these animals. The name is applied in consequence of its offering in many points strong analogies to the other reptiles; but these are not sufficiently close to prevent it from exhibiting a form most strange and anomalous, and a structure equally remarkable, and differing considerably from that of any other animal. The most striking and manifest peculiarity in the plesiosaurus consists in the enormous length of the neck, which, in some species, not only exceeds in absolute dimensions, but also in its proportion to the size of the animal, that of the longest-necked

quadruped or bird. But the perfect mobility of this neck, of which we may form an idea by the number of joints it possesses, was no less remarkable. The giraffe, the longest-necked quadruped we are acquainted with, has only seven vertebræ of the neck, not differing in this respect from the other mammals; the swan, the longest-necked bird, has twenty-three: but the plesiosaurus is known, from some admirably preserved specimens, to have had upwards of thirty, and perhaps as many as forty. In its proportions, the neck in one species measures four times the length of the head, and actually exceeds the entire length of the body and tail. It was apparently thick and muscular near the body, but gradually became slender towards the head, which was small, and sometimes singularly disproportioned in size to the other parts of the animal. The head thus reduced in size exhibits, however, rather a high type of organization. It offers some of the peculiarities which characterize the lizard, especially in the wide interspaces left between the bones; in the existence of a strong crest along the middle of the skull, indicating that the jaws were worked as in lizards and not as in crocodiles; in the structure of the lower jaw; and in the absence of a cross ridge on the fore part of the skull. But in its general form, in the strength and size of the bones of the face and jaws, in the rugged outer surface of the bones, and in the sockets of the teeth, there is a distinct and well-marked approximation to the crocodile.

An Admirable Contrivance.

In the size and position of the breathing-holes, or external nostrils, we find, however, a marked and interesting difference from all existing reptiles, and a strong analogy to the corresponding part in animals allied to the whale, offering a beautiful example of adaptation of structure presented in very different animals, but producing similar results and supplying similar exigencies. These apertures are placed near the highest part of the head, where they would enable the animal most readily to breathe, without exposing anything more than the apertures themselves above the water, corresponding admirably with the marine habits of the animal, as indicated by the structure of its extremities. The jaws of the plesiosaurus are strong and rather spoon-shaped; they were provided with a large number of teeth—probably not less than a hundred—which were conical, slender, long, and pointed, slightly bent inwards, and deeply grooved. These teeth had long fangs, and were planted in separate sockets, as in the crocodile. They could also be repeated and indefinitely renewed. It is probable that the animal could, like some serpents, swallow prey actually larger than the size of its head, the bones being so little attached that the cavity of the mouth could

become greatly dilated by a violent effort. There can be no doubt that the habits of the animal were strictly carnivorous.

The plesiosaurus no doubt fed indiscriminately on whatever came within reach, whether living or dead. Its powers of locomotion in the water were great, and its strength must have been formidable; but it had an enemy in the ichthyosaurus, from which there was probably little chance of escape. We have good reason to suppose that it could move about on shore, and it probably did so with greater facility than the seal or walrus; but it is not likely that it resorted frequently to the land, since the sea appears to have been its more congenial abode. The animal just mentioned as the fierce and powerful enemy of the plesiosaurus, which was itself a voracious reptile, belongs unquestionably to the most remarkable and anomalous species, but departed, perhaps, much less considerably than the other from the present external form of marine animals. With the exception of a larger head, and paddles somewhat more developed, it was not very unlike the porpoise in its appearance, but it was a true reptile, adapted for constant residence in the sea, and in that respect claims comparison as being the ancient representative of the great existing tribe of marine animals, of which the whale is perhaps the best known type.

Jaws Armed with Frightful Teeth.

The head of the ichthyosaurus was in all cases large compared with the general proportions of the body, and in general form it resembled that of the dolphin, the chief part of its magnitude consisting of a greatly elongated snout, like that of some of the aquatic crocodiles of the present day. The jaws are long, comparatively slender, and tapering to the extremity. Along their whole length on both sides there is a continuous row of conical teeth of large size, not inserted in separate sockets, but placed in a kind of trough cut in the jaw, and merely separated from one another by a ridge of bone. These teeth were constantly removed and replaced by new ones during the whole life of the animal, an instance of those wonderful provisions of nature which meet us on every hand, and which show the principle of all-wise design.

The structure of the lower jaw indicates a mechanical contrivance of some interest, intimately connected with the wants and habits of the animal. The jaws themselves are, as we have seen, long and slender. The teeth show that the animal was fierce and voracious, and analogy teaches us that in such cases the jaws must close suddenly on their prey with a snap, in order to ensure a proper hold being obtained. But a slender lower jaw, however strong, would be very easily broken when brought in contact with hard bodies, such as the solid enamelled plates en-

closing some of the fish of the liassic period. By a complicated apparatus of several pieces of bone, arranged so as to distribute in some measure the necessary shock arising from the convulsive jerk made while the animal was in the act of seizing its prey, we have this purpose effected in several of the existing reptiles; but something more than this seems to have been needed by the ichthyosaurus, since it exhibits an example of cross bracing, adding greatly to the effective strength without increasing the weight. By simply introducing a change of direction in the grain, as it is called, or fiber of the bone, this purpose is accomplished, so that the animal was enabled to snap with safety at the hardest and most solid substance that came within its reach. The jaws of some specimens must have been upwards of six feet in length.

A Telescopic Eye.

The most remarkable peculiarity in the head of the fish-reptile besides the jaws is the size and structure of the eye. The eyes were placed far back on the head and behind the snout, with the nostrils or breathing holes just in front, so that each time the animal came to the surface to breathe, the eyes and nostrils, but no other parts of the head or body, would be brought into the air. There can be no question that a voracious animal like the ichthyosaurus, obliged from time to time to appear above water, and perhaps occasionally to come on shore, required an extraordinary provision, enabling it not only to see but to see distinctly, every thing passing around it. It was thus provided with a peculiar apparatus, enabling it to adapt its vision not only to shallow but to deep water, and not only to water but to air. This apparatus effected its purpose by permitting a change of shape of the pupil of the eye, according as circumstances required; the pupil dilating at great depths, where but little light is transmitted, the shape flattening to allow of distant vision on shore, and the whole eye pushed forwards to enable its owner to see objects close at hand, thus affording every variety of action to this important organ. The bony scales which enclosed and defended the soft ball of the eye most resemble what is seen in the golden eagle and some other birds of prey, and may be best understood by a comparison with the scales of the artichoke. The structure is characteristic of reptiles rather than of fishes, and amongst reptiles is most remarkably shown in the lizard tribe.

A Gigantic Bird.

The marvels of the pre-historic world are not confined to quadrupeds nor swimming monsters. Other curiosities have been discovered, although some of them must be assigned to periods less remote than those



THE DINORNIS—A BIRD WITHOUT WINGS.

in which the animals lived which have already been described. Very few of the islands near Australia, except Van Diemen's Land, and very few indeed of those other islands which form the numerous archipelagos of the eastern and southern seas, are sufficiently well known, or have such an extent of superficial deposit, that we could with any reason expect them to furnish many fossil relics. New Zealand is, in point of fact, the only island from which such remains have been obtained; and the condition of the bones, and the circumstances under which they are found, render it impossible to state very decidedly in what bed they there occur. It is, however, something to know that in these islands there existed formerly, and possibly not very long ago, a considerable and important group of wingless birds, of which one representative, the apteryx, still remains, although apparently that also will soon be lost. Many extinct species of these strange animals have been found in the gravel of the northern island, and they vary greatly in size, some having been far larger than the largest ostrich, while others were very small. In all these the general character is nearly the same, the animals being much stouter and more powerful in proportion than the ostrich, and absolutely without any trace of wings.

Great Power and Speed.

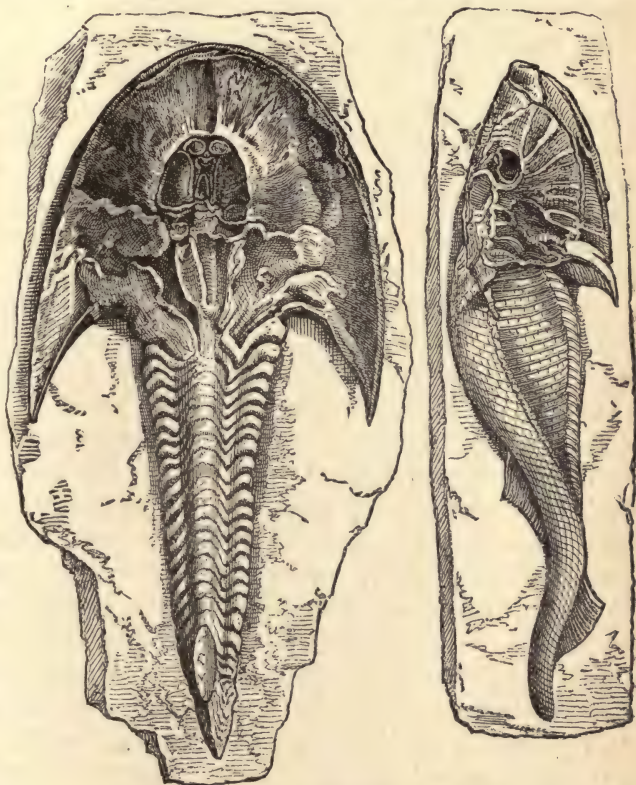
An outline of one of these extraordinary animals, will afford some notion of the vast proportions attained. The various species hitherto determined have all been referred to a single genus, under the name *dinornis*. The legs of the *dinornis* were powerful, and were no doubt well adapted for rapid locomotion; and in the *apteryx* similar powerful extremities enable the animals to run swiftly, and when attacked to defend itself with great vigor. The *apteryx* is nocturnal in its habits, and dwells in the deepest recesses of the forest, where gigantic trees are interwoven almost impenetrably with climbing plants, and where, deeply secluded in the mountains, there occur open swampy spots covered with bulrushes. It feeds on insects and seeds.

The islands of New Zealand, situated to the east of Australia, are still further removed than that continent from the groups of islands in the Indian Ocean; but, in spite of their distance, it is in these latter that we find the nearest approach to the singular wingless birds just described. The dodo, which was brought to England and preserved in museums more than two centuries ago, and figures of which have been given, appears to have inhabited the Mauritius and the island of Bourbon at no distant period, although for some centuries it has not been seen in a living state. Like the extinct wingless birds of New Zealand, it was nearly al-

lied to the cassowary, also an inhabitant of the Mauritius, but it was more massive, and of more clumsy proportions.

There were also creatures in those early ages which dwelt exclusively in the ocean, some traces of which have come down to us, and enable us to understand the nature and characteristics of the tribes that wandered through the great deep. Professor Agassiz discovered, on looking carefully at the numerous species of fish, the fossil fragments of which are

found in the older rocks, that all, without a single exception, belonged to one of two groups. One of these groups is called ganoid, from a Greek word signifying splendor, the scales of these fishes being generally coated with polished enamel, and often exhibiting a very brilliant lustre. It is chiefly the ganoid fishes whose remains are handed down to us in the old red sandstone and other rocks of that period. Sixty



FOSSIL FISHES BEDDED IN ROCK.

distinct species of these fish have been mentioned and most of them are remarkable for exhibiting strange peculiarities of shape, approximating in some instances the structure of the lower order of animals, combined with some apparent likeness to the class of reptiles.

The most extraordinary of these fishes, "the buckler-headed," has a head from which its name is taken. This has been compared to the crescent-shaped blade of a saddler's cutting-knife, the body forming the handle. It is extremely broad and flat, extending on each side consider-

ably beyond the body, and the bones appear to have been firmly soldered together, so as to form one shield, the whole head thus being apparently covered by a single plate of enamelled bone. The body compared with this singular head appears extremely diminutive; the back is arched and gradually recedes in elevation towards the tail, which is of moderate length; the fins are few in number, and not very powerful, but appear to have possessed a bony ray in front, the rest of the fin being more fibrous. The whole body was covered with scales, which varied in shape in different parts, and seemed to have been disposed in series. It has been supposed by Professor Agassiz that the singular shape of the head served as a sort of defence to this animal in case of attack; and one can readily imagine that the soft substance of the largest and most formidable of its enemies, would be injured by any attempt to swallow so singular and knife-like an animal as the one before us.

Like many, and indeed most of the species belonging to the ganoid order of fishes, and common in the older rocks, the bones of the head, and the scales of this strange monster, were composed internally of a comparatively soft bone, but each was coated with a thick and solid plate of enamel, of extreme hardness, and almost incapable of injury by any ordinary amount of violence. The detached scales, the buckler-head, and sometimes the complete outline of the animal, have thus been able to resist destruction, and are found in sandy rocks, composed of such coarse fragments that their accumulation would seem to have been accompanied with violence sufficient to have crushed to powder almost any remains of organized matter, and from which, indeed, we never obtain any fragments of shells or other easily injured substances.

Beautiful Forms in Stone.

The muddy beds deposited after the sandstones, although they contained a considerable proportion of carbonate of lime, were not in a condition favorable for the development of coral existence, and the remains of such animals are accordingly rare. This is not the case, however, with one group of zoophytes, for they were singularly abundant, and were manifestly an important group, perhaps assisting to clear the seas of an undue proportion of the minuter particles of decaying animal matter. The most singular of all these is the pentacrinite, an animal so complicated that the number of separate pieces of stone of which its singular skeleton is made up has been calculated to amount to many thousands.

It was provided with a long and powerful but movable column, made up of a vast multitude of lozenge-shaped pieces, each marked with a curious set of indentations, and each pierced with a central aperture by

means of which a communication was kept up during life, enabling the animal probably to attach itself to some marine substance, or a floating log of wood. In the pentacrinite the stem was five-sided, and the body was partly defended by a small cup formed of regular plates rising from the column, and partly enclosed by a multitude of very minute and angular plates fixed on a tough membranous pouch terminating with an extensive proboscis. The body was surrounded also by an incredible multitude of branching arms, forming a complicated stony net-work, intended to intercept and convey to the stomach the particles of food fit for the animal, which were floating in the water within reach. Many specimens of this fossil are often found together, attached, it would seem, to what was once under surface of decayed wood drifting through the water.

Fossil shells make up a large part of the relics deposited by the ancient seas, and in numerous instances these appear to be scarcely altered from their original pattern. In other cases only an impression of the external form is left; sometimes an entire cast of the shell, exterior and interior. In

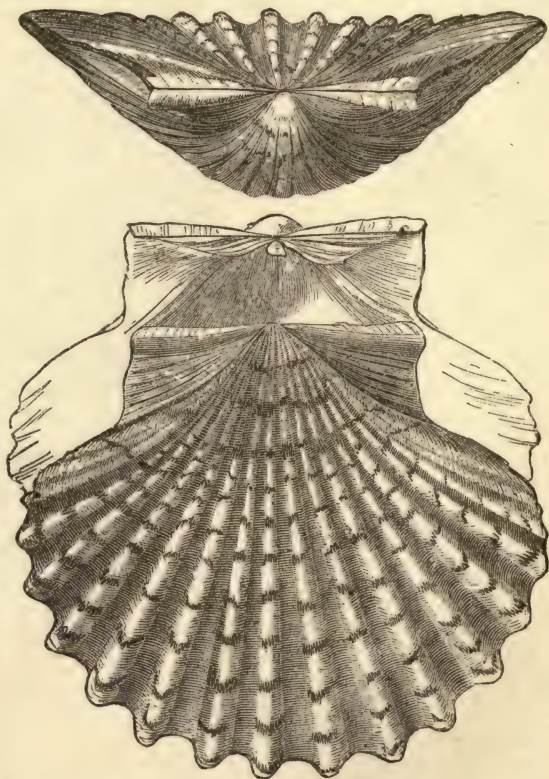
other cases the shell has left a perfect impression of its form in the imbedding mud, and has then been dissolved and washed away, leaving its mould. This mould, again, has sometimes been filled up by soft substances, and an exact cast of the original shell obtained—a petrified shell, in short. Petrified wood is equally common. The existence of marine



A ZOOPHYTE WITH FIVE-SIDED STEM.

shells upon the summits of mountains had already struck the mind of the ancient authors. Witness Ovid, who in his celebrated book called the "Metamorphoses," tells us he had seen land formed at the expense of the sea, and marine shells lying dead far from the ocean; and more than that, an ancient anchor had been found on the very summit of a mountain. The Danish geologist Steno, who published his principal works in Italy about the middle of the seventeenth century, had deeply studied the fossil shells discovered in that country. The Italian Painter Scilla produced a Latin treatise on the fossils of Calabria, in 1760, in which he established the organic character of fossil shells.

In France the celebrated Buffon gave, by his eloquent writings, great popularity to the notions of the Italian naturalists concerning the origin of fossil remains. In his admirable 'Epoques de la Nature' he sought to establish that the shells found in great quantities buried in the soil, and even on the summit of mountains, belonged, in reality, to species not living in our days. But this idea was yet too



EXQUISITE FOSSIL SHELLS.

new not to find objectors: it counted among its adversaries the hardy philosopher who might have been expected to adopt it with most ardor. Voltaire attacked, with his jesting and biting criticism, the doctrines of the illustrious innovator. Buffon insisted, reasonably enough, on the existence of shells on the summit of the Alps, as a proof that the sea had at one time occupied that position. But Voltaire asserted that the shells found on the Alps and Apennines had been thrown there by pilgrims returning from Rome. Buffon might have replied

to his opponent by pointing out whole mountains formed by the accumulation of shells. He might have sent him to the Pyrenees, where shells of marine origin form immense mountains rising six thousand six hundred feet above the present sea level. But his genius was averse to controversy; and the philosopher himself put an end to a discussion in which perhaps he would not have had the best of the argument. "I have no wish," he wrote, "to embroil myself with Mr. Buffon for a few shells."

The vale in which the brilliant city of Paris now stands was once a lake or bay, whose shores were fringed with forests of palms. Strange animals, whose species have long since passed away, sported in its waters, whilst huge crocodiles lurked amongst the thick reeds and large water-lilies watching for their prey. The valley is known in geology as the Paris basin, just as the corresponding formation in the Thames is named the London basin. They both belong to the tertiary period, so called because it was the third in three great systems of rock formation; the rocks being composed of the sedimentary deposit of water, and not, as in those of the first ages, produced by the action of fire: those in the vicinity of Paris being in strata or layers, containing alternately fresh-water and marine shells, showing that the valley of the Seine was at one time a fresh-water lake, and, at another, an arm of the sea.

Skeletons of Animals Found Near Paris.

At Montmartre, a hill a little to the north of Paris, there are extensive quarries of gypsum, the material known to us as plaster of Paris. Gypsum is composed of sulphate of lime, deposited by fresh water; and in digging these quarries a great number of skeletons of various animals were discovered, some of them being nearly perfect, having been preserved by the gypsum which had hardened about them. And Cuvier, the great French naturalist, restored them, and we can have a distinct idea of what these strange creatures were like, in every particular except their color.

At the commencement of the tertiary period, the heat, though not so intense as it had been in the preceding ages, when the tepid swamps teemed with monstrous reptiles, was still as great in England and France as it is now in the tropics. But the temperature was slowly cooling, and the forests of palms were mixed with trees which still flourish in these climates, such as the oak, wych-elm, alder, cypress, walnut, and others. The gigantic saurians of the red sandstone age were extinct and appeared no more in the earth, and there grew into life the great pachyderms, or thick-skinned animals; instead of the dragon-like pterodactyle, the air was filled with quails, woodcocks, and curlews, and all nature wore a new aspect.



ANTEDILUVIAN ANIMALS OF THE VALLEY OF PARIS.

The animals which were so abundant in the Paris basin belonged chiefly to two genera: the palæotheria, or ancient animals, and the anoplotheria or unarmed animals; these latter, were so called from the Greek words for "unarmed," and for "beast," because their teeth were arranged in an even line all round, just as in man; the canine teeth not projecting beyond the others, as they do in animals which can bite and tear, so that they were defenceless. There were several species of palæotheria, the largest, or great palæotherium, being about the size of a horse, but it was much heavier and clumsier, having a very thick body, supported on short, stout legs, and its feet were divided into three rounded toes. Its head was large, and was provided with a short trunk, or proboscis, like that of the tapir; and altogether it formed a link between that animal and the rhinoceros, and probably resembled them in its habits.

The anoplotheria also comprise several species, differing greatly from each other. The largest was about the size of a donkey but, though belonging to the pachydermata, the anoplotherium was like no one animal now existing, for whilst in some respects it resembled the hippopotamus, its skull partook of the character of that of the horse, and its upper lip was divided, like the camel's; and the bones of the feet, which were separated into toes sheathed in hoofs, were like those of the hog. The body was about four feet long, and it had a thick tail of equal length, probably to assist it in swimming; and its hair was smooth, like that of the otter.

The Gazelle of the Early Ages.

Another kind, the xiphodon gracile, was about the size of a chamois, and was as light and slender as a gazelle; and instead of swimming in the water, it bounded over the plains; but though in this respect it resembled a deer, and had a long neck and a short tail, its lip also was divided like the camel's. Some of the species were very small, one being only as large as a hare, whilst another was no bigger than a rat. It is difficult to imagine creatures more defenceless than these animals were, possessing neither horns nor claws, nor teeth that they could tear with; and they were probably soon exterminated when the large beasts of prey came into existence. As it was, the chief enemies of those that frequented the water must have been the crocodiles. The anoplotheria were all herbivorous, living on seeds and green twigs, or the succulent roots of plants.

Remains of the palæotherium and an oplotherium have been discovered in the Isle of Wight, in strata similar to that of the Paris basin, but not in such abundance. Altogether, Cuvier found the bones of about fifty different kinds of animals embedded in the gypsum, all of which are extinct,

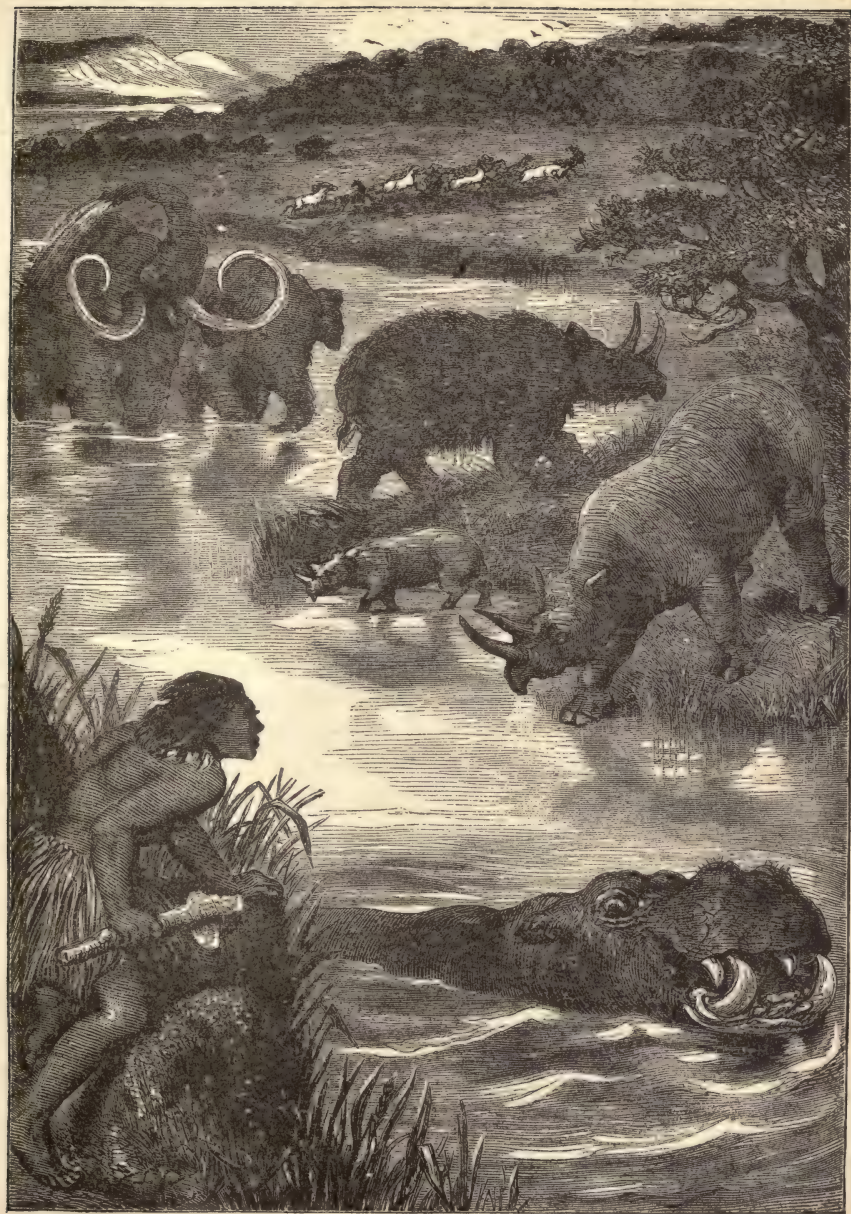
besides turtles, and crocodiles, and bats, and various birds of kinds which still exist on the earth.

Though Britain is now an island it was not always so. The researches of geologists show that it was once united to the continent of Europe. The fossil remains of animals discovered in many parts of England are the same as those found in France, and a species of fresh-water mussel, now extinct in that country, still lives in the river Seine. The flint implements, too, which prove that even at that early age human beings existed on the earth, though there was no historian to chronicle their deeds, are found to be of a similar type in England and France, and seem to show that, at a far distant time, the same race of people inhabited both countries. But these men were not our ancestors; they died out, or were exterminated by the influx of tribes superior to them in intelligence, and the shape of their skulls, which have been dug up out of the gravel beds in France, shows that they belonged to a different race from any now inhabiting either country.

London Once a Great Menagerie.

At that time the valley of the Thames must have presented a very different aspect from what it does now, and it is supposed that the river Thames was then a tributary of the Rhine. The vegetation was of much the same character as at present, for, after lasting countless ages the great tertiary period had come to an end; England was no longer covered with groves of palm-trees and tropical ferns, and the strange animals of the Paris basin were already extinct. The temperature, that had been gradually cooling, at length became so cold that what is known as the glacial period, or age of ice, ensued. After a long interval, the climate grew warm again, and it was at this time that man came into existence; at least we may conclude so, for there are no certain vestiges of human beings before the age of ice. The forest trees such as we still now have, appeared, and dense forests of oak, and elm and thickets of alder grew to the water's edge. The climate too was probably not very different to what it is now, except that the winter was colder and the summer hotter than in our day.

But if the trees on the banks of the Thames were of the same kind as at present, it was far otherwise with the animal kingdom, for the gigantic mammoth browsed on the young shoots of the oak, whose branches gave shelter to troops of apes, whilst the woolly rhinoceros wallowed in the mud and the huge hippopotamus came swimming up the river. The wild horse and the ass scoured the plains, and herds of bisons and wild bulls roamed through the woods, that at night echoed with the



ANCIENT ANIMALS IN THE THAMES VALLEY.

cries of the hyena or the growling of immense tigers. There were several distinct species of rhinoceri natives of Britain and other parts of Europe, but they were not all co-existent. They first appear about the middle of the tertiary period, but the species that lived then appears to have given place to other kinds. Of these the woolly rhinoceros, which had two horns, was the most common, and its remains have been found in an entire state in the ice of northern Asia. Besides its woolly coat it had another peculiarity, which does not exist in every living species—its nostrils were separated by a bony partition. There was also a smaller and more slender species, which had two horns, and another kind, no larger than a hog. The hippopotamus, of which there were two species, did not differ much from that of Africa. Its bones have been found, together with those of the rhinoceros, in many parts of London; and a jaw-bone of a hippopotamus, armed with a formidable pair of tusks, was dug up at Peckham, and is now in the geological collection of the British Museum.

A Multitude of Savage Creatures.

It was at the close of the tertiary period, and just before the appearance of man, that many of the animals appeared which still inhabit Britain, such as the hog and the horse; but the first horses were very small, being no larger than the donkey: there are no fossil remains of such horses as we see now-a-days. One species of the deer was of gigantic size, and there was a large serpent, and the caves were the abode of huge bears, that exceeded the grizzly bear of North America in size; and a terrible creature, called the machairodus, now totally extinct, preyed on the denizens of the woods. Flocks of birds flew through the air, and vultures brooded on the rocks. Beavers constructed their dwellings in the stream, and were not extinct till historic times.

In the valley of the Thames the remains of both arctic and tropical animals are found, and the reindeer, glutton, musk-sheep, and even the lemming, once frequented Britain. It might be imagined that these animals lived at different periods, but the bones of hippopotami are found with those of the reindeer, and it is probable that as England was then united to the Continent, and the land continuous, the animals migrated according to the change of the seasons, and the hippopotamus swam up the rivers from France and Spain. The reindeer extended its wanderings as far as the south of France, where it was at one time very common.

Amid the multitude of savage animals which then swarmed in these countries, the primitive human beings must have led a precarious existence. Armed only with flint-headed arrows and axes, or bone-pointed

spears, they doubtless frequently fell a prey to the tiger or terrible cave-bear. Their skeletons show that they were a small race of men, with round heads and low foreheads, and very prominent ridges over the orbit of the eye. They were probably something like the Eskimo or Laplanders, and their lives were spent in hunting or in resisting the attacks of wild beasts.

Remarkable Products of Land and Sea.

The shores of the islands or of the tract of main land then existing were apparently low and swampy. Deep inlets of the sea, bays, and the shifting mouths of a river, were also affected by numerous alterations of level not sufficient to destroy, but powerful enough to modify the animal and vegetable species then existing; and these movements were continued for a long time. The seas were tenanted by sharks, gigantic rays, and many other fishes of warm latitudes, and abounded also with large carnivorous mollusca, capable of living either in fresh or brackish water. The shelving land was clothed with rich tropical vegetation to the water's edge, presenting to view the palm and the cocoa-nut, besides many of those trees which now lend a charm to the Spice Islands of the Indian seas. All these abounded also with indications of animal life.


The large rivers were peopled with crocodiles; turtles and tortoises floated upon them; and these tenants of the waters, strange and varied as they were, and unlike the present inhabitants of the district, were not without resemblance to many species still met with on the earth. The interior of the land, of which the surrounding waters were thus peopled, was no less remarkable, and exhibited appearances equally instructive. Troops of monkeys might be seen skipping lightly from branch to branch in the various trees, or heard mowing and chattering and howling in the deep recesses of the forest. Of the birds, some clothed in plumage of almost tropical brilliancy, were busy in the forests, while others, such as the vulture, hovered over the spots where death had been busy. Gigantic serpents might have been seen insidiously watching their prey. Other serpents in gaudy dress were darting upon the smaller quadrupeds and birds, and insects glittered brightly in the sun.



CHAPTER III.

THE TERRIBLE PHENOMENA OF EARTHQUAKES.

Nature's Destructive Agencies—Tremendous Forces Pent up Within the Earth—Frequency of Earthquake Shocks—A Country in South America Never Quiet—Signs of the Approaching Disaster—A Part of our own Country Sunk by a Convulsion—The Great Earthquake of Calabria—Human Beings Tossed in the Air—Heavy Objects Whirling About—Farms Changing Places—Jamaica Visited—Destruction of the City of Lisbon—The Sea Rushing Madly on the Shore—Terrible Loss of Life—Horror Multiplied—Immense Fissures in the Earth—Great Calamity at Messina—Statistics Showing Appalling Destruction of Life—Charleston in Terror—Java and Southern Europe Shaken.

ARTHQUAKES are the most fearful, and at the same time the most destructive, phenomena of nature. They are motions produced on the earth's solid surface by a force originating in the interior of the globe, and thence acting upward. This force appears to be subject to great variations in its intensity. In most cases the commotions occasioned by it on the earth's surface are exceedingly slight. The motion is scarcely felt, and passes away in the same moment. The larger number of earthquakes consist of a slight trembling of the ground, which can only be perceived by attentive observation, and then only under very favorable circumstances. When they have passed away, it is impossible to discover the slightest traces of their transitory activity. But at other times they are attended with effects so terrible and destructive, that no other calamity can be compared with them. When the subterraneous force to which they owe their origin acts with a violent degree of energy, it produces such convulsions on the earth's surface, that not only are the works destroyed that men have raised to render their lives comfortable, and the buildings levelled to the ground that they have erected to protect them against the inclemency of the seasons, but in some cases the face of the country is changed that has been subjected to their operation. It is happily the case that earthquakes attended with such fearful effects are not of frequent occurrence; they would otherwise render the countries visited by them uninhabitable for man and beast.

Frequency of Earthquakes.

In countries frequently subject to earthquakes, only those convulsions which are attended by destructive consequences are remembered by the

inhabitants for any long time after. The slight ones are hardly noticed, or are only recorded by some curious observer. It appears, therefore, to persons living at a great distance from such places, and receiving information of them only when producing some great calamity, that earthquakes are not frequent, and occur only at periods remote from each other. This, however, is an error. Earthquakes are very frequent. By an exact observer not less than fifty-seven earthquakes have been noticed within the space of forty years in the town of Palermo, in Sicily, which were attended by such smart shocks as to be sensibly felt.



EFFECT OF AN EARTHQUAKE ON THE SEA.

In the town of Copiapo, in the extreme northern province of Chile, one or more shocks are felt almost every day; and though they commonly pass off without causing any damage, the town has suffered by them so frequently, and so many lives have been lost by the downfall of buildings, that the inhabitants rush out of their houses as soon as the least commotion of the earth is perceived. If it were possible, says Humboldt, to obtain daily information respecting the state of the whole surface of our globe, we probably should convince ourselves that this surface is

nearly always shaken at some point or other, and that it is subject to an uninterrupted reaction between the interior and the exterior.

Signs of Coming Destruction.

Many persons are apt to suppose that those countries which are situated in the vicinity of active volcanoes are more frequently subject to violent concussions than those which lie at greater distances from them. This opinion is not correct; but it is true that earthquakes are common in the neighborhood of volcanoes. Every eruption of the mountain, and even every new flow of lava, or every ejection of ashes, is accompanied by a shock, which, however, is so slight, that it can only be perceived by persons who are near the crater, or on the declivities of the volcano. These slight shocks can hardly be considered as earthquakes, as they are not felt in the plain at its base. But many eruptions are preceded by real earthquakes. When the inhabitants of a country surrounding an active volcano observe that the mountain has ceased to emit smoke from its crater, they consider it as a sign of an approaching earthquake, and in many cases their fear has not proved unfounded. It may be true that earthquakes are most frequent in countries lying in the vicinity of a volcano; but few of the more disastrous convulsions of this description have occurred in such localities. The greater number have happened at considerable distances from any active volcano, and even from places which by the nature of the rocks show that they have once been the seat of volcanic activity. It is also observed that earthquakes occurring at no great distance from volcanoes are of comparatively short duration, whilst the convulsions visiting countries lying far from them are repeated almost daily for months together, and frequently several times in one day. Of such a description were the earthquakes which were experienced during more than a whole year (1812) in the plains of the Mississippi, and those which shook, in 1808, the Alpine valleys lying at the base of Mount Cenis.

A Country Sunk by a Convulsion.

That part of the plain of the Mississippi River, which, in 1812, experienced a great number of strong concussions, and those repeated for several months together, extends between New Madrid, on the Mississippi, to the Little Prairie, north of Cincinnati. The principal seat of the earthquake was consequently nearly equi-distant from the Gulf of Mexico and from the Atlantic Ocean. The following particulars respecting this earthquake are from Sir Charles Lyell: Flint, the geographer, who visited the country seven years after the event, informs us that a tract of

many miles in extent, near the Little Prairie, became covered with water three or four feet deep; and when the water disappeared a stratum of sand was left in its place. Large lakes, of twenty miles in extent, were formed in the course of an hour, and others were drained. The graveyard at New Madrid was precipitated into the bed of the Mississippi; and it is stated that the ground whereon the town is built, and the river bank for fifteen miles above, sank eight feet below their former level. The neighboring forest presented for some years afterwards a singular scene of confusion; the trees standing inclined in every direction, and many having their trunks and branches broken.

The inhabitants relate that the earth rose in great undulations; and when these reached a certain fearful height, the soil burst, and vast volumes of water, sand, and pit coal were discharged as high as the tops of the trees. Flint saw hundreds of these deep chasms remaining in an alluvial soil, seven years after. The people in the country, although inexperienced in such convulsions, had remarked that the chasms in the earth were in a direction from S. W. to N. E.; and they accordingly felled the tallest trees, and laying them at right angles to the chasms, stationed themselves upon them. By this invention, when chasms opened more than once under these trees, several persons were prevented from being swallowed up. At one period during this earthquake, the ground not far below New Madrid swelled up so as to arrest the Mississippi in its course, and to cause a temporary reflux of its waves. The motion of some of the shocks is described as having been horizontal, and of others perpendicular; and the vertical movement is said to have been much less desolating than the horizontal.

Human Beings Hurled Through Space.

The upheaving shocks are accompanied by violent upliftings of the earth, as if repeated explosions were exerting their force upon the roof of a hollow cavern, threatening to burst open the ground and blow into the air every thing placed on it. They may also be compared to the bursting of a mine, which explodes with great force and removes the earth which it meets within its passage. When the surface of the earth is split by them, it is hardly to be conceived what terrible destruction must be produced in a few minutes by such convulsions following each other in quick succession. There are numerous instances on record which prove the immense force with which these shocks act on the surface and on everything on it; some of them, indeed, appear almost incredible. In the great earthquake of Calabria, 1873, the most elevated portion of the granite mountain mass of the Aspromonte was seen to move up and down

rapidly; persons were raised from the ground and thrown to a distance from the place where they were; houses were removed from their site and carried to places higher than those on which they had been built. The foundation of many buildings was removed from beneath the ground with such violence, that the stones were broken to pieces and scattered about, and the hard cement which had united them was crushed into dust. After the great earthquake of Riobama, in 1797, on the table land of Quito, the corpses of several of the inhabitants of the town were found on the top of a hill, separated from the place by a river, and several hundred feet higher than the site of the town. These persons had been hurled to the top of the hill by the violent upheavings of the ground.

The rotatory shocks are certainly the most destructive, but are those also which occur most rarely. They have only been observed in the most calamitous earthquakes, and not in all of them. The whirling motion puts the surface of the earth into a movement resembling that of the sea when agitated by irregular waves crossing and repulsing each other in different directions. In the earthquake of Catania, in Sicily, in 1818, many statues were turned round, and a large piece of rock had its former position from south to north changed to that of east to west. Several instances of this kind were observed after the great earthquake of Valparaiso, in Chili, when that town was levelled to the ground. The large church La Merced presented the most remarkable ruin. The tower was built of bricks and mortar, and its walls up to the belfry were six feet thick. They were shivered into blocks, and thrown to the ground. On each side of the church were a number of square buttresses of good solid brick work, six feet square. Those on the western side were all thrown down, as were all but two on the eastern side; these two were twisted from the wall in a north-easterly direction, each presenting an angle to the wall. The twisting to the north-east was noticed in several other places. In a village thirty miles north of Valparaiso, the largest and heaviest pieces of furniture were turned in the same direction.

Singular Confusion Caused by the Moving of the Ground.

In some instances it has been found that large pieces of ground had exchanged their respective situations. This was the case at several places in Calabria, after the first great shock had passed by. A plantation of mulberry trees had been carried into the middle of a cornfield, and left standing there; and a piece of ground sown with lupines had been forced into a vineyard. For several years after the earthquake, lawsuits were brought in the courts of Naples to decide the claims which had originated in the confusion of territorial possessions by the effects of that terrible

catastrophe. Facts of a similar description are recorded as having resulted from other earthquakes, such as that of Riobamba, where also several lawsuits were brought in the courts respecting the possession of pieces of ground, which had exchanged their positions. But Humboldt has recorded a still more extraordinary fact. When he was surveying the ruins of the destroyed town of Riobamba for the purpose of making a map, he was shown the place where the whole furniture of one house was found buried beneath the ruins of another. The upper layer of the soil, formed of matter not possessing a great degree of coherency, had moved like water in running streams; and we are compelled to suppose that these streams flowed first downwards, then proceeded horizontally, and at last rose upwards. The motion in the shocks which were experienced in Jamaica, 1692, must have been not less complicated. According to the account of an eye witness, the whole surface of the ground had assumed the appearance of running water. The sea and the land appeared to rush on one another, and to mingle in the wildest confusion. Some persons, who, at the beginning of the calamity, had escaped into the streets, and to the squares of the town, to avoid the danger of being crushed under the ruins of the falling houses, were so violently tossed from one side to the other, that many of them received severe contusions, and some were maimed. Others were lifted up, hurled through the air, and thrown down at a distance from the place where they had been standing. A few who were in the town were carried away to the harbor, which was rather distant, and there thrown into the sea, by which accident, however, their lives were saved.

The Terrible Earthquake of Lisbon.

The earthquake of Lisbon happened on the 1st of November, 1755. The day broke with a serene sky and a fine breeze from the east. About nine o'clock in the morning the sun began to grow dim, and about half an hour later a rumbling noise was heard, which proceeded from under ground, and resembled that made by heavy carts passing over a distant ground covered with pebbles. This subterraneous noise increased gradually, but quickly, so that after a few seconds it resembled the firing of cannons of heavy calibre. In this moment the first shock was felt. Before its violent concussions the foundations of many large buildings, especially the palace of the Inquisition and several churches gave way, and the whole of these edifices were levelled to the ground. After a short pause, perhaps of not more than a minute's duration, three other shocks followed in quick succession, by which nearly all the other larger buildings, palaces, churches, convents, public offices, and houses

were thrown down. All these shocks occurred in a space of less than five minutes.

At the time the first shock was felt in the city, some persons were in a boat on the Tagus River, about three miles distant from the capital. They were astonished at hearing the boat making a noise, as if it were running aground, as they knew it was in deep water. In the same moment they observed on both banks of the river that the buildings were tumbling down. About four minutes later a similar noise was



DESTRUCTION OF LISBON BY AN EARTHQUAKE.

heard under the boats, and other buildings were seen falling to the ground. During this time a strange commotion was observed in the water of the river. It appears that at some places the bottom of the river was raised to the level of the water. Many vessels were lying in the harbor opposite the town. Some of them were torn from their anchors and dashed against each other with great violence; in others the sailors did not know whether their vessels were afloat or aground.

The minds of the inhabitants had not yet had time to recover from the terror caused by this terrible and quite unexpected catastrophe, when they were again plunged into dismay by a phenomenon of a different description, but hardly less terrible and destructive. About half an hour after the most severe shocks had ceased, the sea rushed suddenly with incredible velocity into the river. Although the water had been ebbing for two hours, and the wind blew fresh from the east, the sea at the mouth of the Tagus rose instantaneously about forty feet above high water mark. It would certainly have laid more than half the town under water, and completed the work of destruction, had not the large bay, which the river forms opposite the capital of Portugal, permitted this enormous volume of water to spread itself over a surface of many square miles. But even this favorable circumstance did not entirely exempt the city from the effects of an inundation. The sea entered the lower streets, and a large stone-built quay, which had been probably detached from its foundations by the earthquake, and on which about three thousand people had taken refuge, was suddenly hurled bottom upward, and every soul was lost. As quickly as the water had filled the river, so quickly did it retreat to the sea. The high wave, however, returned three or four times before the water attained its usual level, but every time with a diminished force and a less volume of water.

Frightful Loss of Life.

It is stated that, by the effects of the earthquake and of the inundation, not less than sixty thousand persons perished. The larger number, it appears, were crushed by the ruins of the falling churches. For as it was a holiday, a great number of persons were at their devotions in the churches and convents, which, being very substantial edifices built of stone, suffered much more than the houses of private persons, and were reduced to heaps of ruins by the first shock. Towards evening a smart shock was felt; it was strong enough to split the walls of several houses which had still kept their position. The rents caused by this shock in the walls of these houses were more than half a foot wide; but as soon as the shock had passed away, they closed again, and so firmly that it was impossible to find a trace of them.

In addition to the horrors occasioned by the shocks of the earthquake and the inroads of the sea, the devoted inhabitants were exposed to the ravages of fire. An English merchant residing in Lisbon, who escaped, and published an account of the calamity, says: As soon as it grew dark another scene presented itself, little less shocking than those already described—the whole city appeared in a blaze, which was so bright that I

could easily see to read by it. It may be said without exaggeration, it was on fire in a hundred different places at once, and thus continued burning for six days together, without intermission, or the least attempt being made to stop its progress. It went on consuming everything the earthquake had spared, and the people were so dejected and terrified, that few or none had courage enough to venture down to save any part of their substance; every one had his eyes turned towards the flames, and stood looking on with silent grief, which was only interrupted by the cries and shrieks of women and children calling on the saints and angels for succor, whenever the earth began to tremble, which was so often this night, and indeed I may say ever since, that the tremors, more or less, did not cease for a quarter of an hour together. I could never learn that this terrible fire was owing to any subterraneous eruption, as some reported.

Horror Added to Horror,

The 1st of November being All Saints Day, a high festival among the Portuguese, every altar in every church and chapel (some of which have more than twenty) was illuminated with a number of wax tapers and lamps, as customary; these setting fire to the curtains and timber work that fell with the shock, the conflagration soon spread to the neighboring houses, and being there joined with the fires in the kitchen chimneys, increased to such a degree that it might easily have destroyed the whole city, though no other cause had occurred, especially as it met with no interruption. The nobility, gentry, and clergy, who were assisting at divine service when the earthquake began, fled away with the utmost precipitation, every one where his fears carried him, leaving the splendid apparatus of the numerous altars to the mercy of the first comer; but this did not so much affect me as the distress of the poor animals, which seemed sensible of their hard fate; some few were killed, others wounded, but the greater part, which had received no hurt, were left there to starve.

From the square the way led to my friend's lodgings, through a long, steep, and narrow street; the new scenes of horror I met with here exceed all description; nothing could be heard but sighs and groans. I did not meet with a soul in the passage who was not bewailing the death of his nearest relations and dearest friends, or the loss of all his substance; I could hardly take a single step without treading on the dead or the dying; in some places lay coaches, with their masters, horses, and riders, almost crushed in pieces; here mothers with their infants in their arms; there ladies richly dressed, priests, friars, gentlemen, merchants, either in the same condition or just expiring; some had their backs or thighs broken, others vast stones on their breasts; some lay almost buried in

the rubbish, and crying out in vain to the passengers for succor, were left to perish with the rest.

In Asia, Africa, Europe and South America, as we have seen, earthquakes have levelled whole cities and numbered their victims by tens, and in some instances hundreds, of thousands. In Judea, at the time of the battle of Actium, 31 B.C., an earthquake killed ten thousand people. Antioch has been visited by several of still greater magnitude, one of which, 526 A.D., is said by Gibbon to have slain two hundred and fifty thousand persons; and the same city was visited about sixty years later by another that made thirty thousand corpses. The earthquake, with volcanic eruption of Vesuvius, that wiped out Herculaneum and Pompeii in the year 63, need only to be mentioned. In more modern times earthquakes have slain one hundred thousand at Calabria, Sicily, in 1783; and twelve thousand in the Argentine Republic in 1861. These are only a few of the great calamities of this kind that history records.

More Recent Convulsions.

No earthquake has visited the territory of the United States within the historical period which can be compared in extent or energy to the convulsion in August, 1886, that was felt from the Mississippi to the Atlantic, and which wrought such terrible disaster in Charleston, yet shocks similar in character but less in degree are of constant occurrence. Observations show that on the Atlantic slope there is on an average one disturbance of this kind every month. These, however, as compared with the calamities which have desolated other parts of the world are very small and insignificant. In the Charleston disaster ninety-six persons lost their lives, a very insignificant number compared with the destruction, graphic accounts of which come to us from other quarters of the globe. In the early part of 1887 a frightful earthquake in the southern part of Europe destroyed more than 2000 lives, and spread desolation and suffering over a wide territory. Neither cholera nor any other pestilence has more reason to be dreaded than one of those terrible convulsions which demolish the most massive buildings, wreck the fairest cities, and in an instant hurry multitudes of human beings out of the world. •

One of the most destructive earthquakes of modern times was that which, in the Island of Java in 1884, destroyed thirty thousand lives, and engulfed a range of mountains forty miles in length, leaving no trace of the line along which it extended. Immense clouds of dust extended even to the opposite hemisphere. The whole civilized world had its attention awakened by this extraordinary convulsion. It literally buried mountains as we bury the dead.

In the earthquake at Charleston many buildings were demolished, and great destruction of property resulted from the terrible visitation, yet considering the frightful havoc made by some European earthquakes, our American city was extremely fortunate. The truth of this statement will appear if we look at the account given of that tremendous convulsion in the island of Sicily which overthrew nearly the whole of the beautiful city of Messina, with a great loss of life. The shore for a considerable distance along the coast was rent, and the ground along the port, which was before quite level, became afterwards inclined towards the sea, the depth of the water having, at the same time, increased in several parts, through the displacement of portions of the bottom. The quay also subsided about fourteen inches below the level of the sea, and the houses near it were much rent.

A Graphic Description of the Awful Calamity.

But it was in the city itself that the most terrible desolation was wrought—a complication of disasters having followed the shock, more especially a fierce conflagration, whose intensity was augmented by the large stores of oil kept in the place. An authentic account of this calamity has been preserved in a report sent by the Senate of the city of Messina to the King of Naples. It runs as follows: Your Majesty's feeling heart will, we doubt not, be touched by the deepest sorrow at the harrowing spectacle of a splendid city instantaneously changed, by a terrible and unexampled event, into a heap of ruins. The concussions of the earth, coming in succession every quarter of an hour, with inconceivable violence, have overthrown, from top to bottom, every building whatever. The royal palace, that of the archbishop, the whole of the maritime theatre, the pawn repositories, the great hospital, the cathedral, the monasteries and nunneries—nothing has escaped destruction. The religious recluses are seen running through the streets in dismay, to seek, if possible, some place of refuge and safety, with the small number of persons escaped like themselves, almost by a miracle, from this overthrow. The sight is fearful; but there is one yet more terrible—that of the largest proportion of the citizens, dead and dying, buried beneath the ruins of their dwellings, without its being possible, from the want of laborers, to render assistance under such circumstances, to withdraw from beneath the rubbish those still breathing. Shrieks and cries, groans and sighs—all the accents of grief are everywhere heard; while the impossibility of redeeming from death those wretched victims, renders still more harrowing the voice of despair that appeals in vain for help and compassion.

A new scourge has been added to all these calamities, and augments their horror. From amid the ruins of the overthrown buildings there is seen all at once to arise a raging fire. Unhappily—the first shocks having begun about dinner-time—the fires, then lighted in the kitchens, had kindled various combustible substances found among the remains of the crumbling houses. The king's lieutenant instantly hastened to the spot with his troops; but the absolute want of laborers and needful appliances rendered all efforts unavailing, and it was impossible, not only to extinguish the fire, but even to stop the progress of the flames, which contin-



DESTRUCTION OF MESSINA.

ued to devour the sad remains of a city, once the glory of her sovereigns, and the most flourishing in the kingdom.

To so many simultaneous disasters have to be added a thousand others beyond description horrible. The corn magazines having been overthrown, bread, that most needful of aliments, fails. The Senate has been obliged immediately to remedy this evil, by detaining in harbor the vessels laden with this commodity. But how make bread when the shops and utensils adapted to this trade are buried under the ruins, while the bakers have either perished or fled? The water-courses having been turned aside, the public fountains are drained, and the mills can no longer grind corn. This aggravation of disasters has reduced almost to

despair the remaining inhabitants, who demand with loud cries bread for their sustenance. Some bemoan their goods and chattels, others their parents.

In spite of the zeal and activity shown by the magistrates in restraining robbers, there are yet to be found wretches, without either humanity or religion, who, regardless of this Divine wrath displayed before their eyes, have pillaged not only private houses but also the public edifices and the pawn-repositories. Naught then, save the powerful protection of your Majesty, can redress such manifold misfortunes, so rapid in their succession, and give new existence to this city, which requires to be wholly restored. The Senate beseeches your Majesty instantly to transmit the needful succors of men and money, to clear the roads covered by ruins



FISSURES PRODUCED BY AN EARTHQUAKE.

and corpses. The Senate equally entreats your Majesty to send to this city provisions of all sorts, for the subsistence of the inhabitants dispersed in the plains, and who, destitute of food, will be obliged to take flight, to the great detriment of your royal treasury.

According to official reports made soon after the events, the destruction caused by the earthquakes throughout the two Calabrias was immense. The loss of life was appalling—40,000 having perished by the earthquakes, and 20,000 more having subsequently died from privation and exposure. The greater number were buried amid the ruins of the houses, while others perished in the fires that were kindled in most of the towns, particularly in Oppido, where the flames were fed by great magazines of oil. Not a few, especially among the peasantry dwelling in the country, were suddenly engulfed in fissures, which, seen in all directions, gave the

ground the appearance of having been shivered like glass. Many who were only half buried in the ruins, and who might have been saved had there been help at hand, were left to die a lingering death from cold and hunger. Four Augustine monks at Terranuova perished thus miserably. Having taken refuge in a vaulted sacristy, they were entombed in it alive by the masses of rubbish, and lingered for four days, during which their cries for help could be heard, till death put an end to their sufferings.

A Mother and Child Perish.

Of still more thrilling interest was the case of the Marchioness Spadara. Having fainted at the moment of the first great shock, she was lifted by her husband, who, bearing her in his arms, hurried with her to the harbor. Here, on recovering her senses, she observed that her infant boy had been left behind. Taking advantage of a moment when her husband was too much occupied to notice her, she darted off, and, running back to her house, which was still standing, she snatched her babe from his cradle. Rushing with him in her arms towards the staircase, she found the stair had fallen—so barring all further progress in that direction. She fled from room to room, chased by the falling materials, and at length reached a balcony as her last refuge. Holding up her infant, she implored the few passers-by for help; but they all, intent on securing their own safety, turned a deaf ear to her cries. Meanwhile her mansion had caught fire, and ere long the balcony, with the devoted lady still grasping her darling, was hurled into the devouring flames.


A few cases are recorded of devotion similar to that of this heroic woman, but happily attended by more fortunate results. In the great majority of instances, however, the instinct of self-preservation triumphed over every other feeling, rendering the wretched people callous to the dangers and sufferings of others. Still worse was the conduct of the half-savage peasantry of Calabria. They hastened into the towns like vultures to their prey. Instead of helping the sufferers, they ransacked the smoking ruins for plunder, robbed the persons of the dead, and of those entangled alive among the rubbish, perpetrating still more atrocious crimes.

Several cases occurred of persons being rescued alive from the ruins after the lapse of many days. Some were delivered at the end of three, four, or five days, and one even on the seventh day after interment. Those who were thus rescued all declared that their direst sufferings were from thirst.

CHAPTER IV.

MOUNTAINS OF FIRE.

Terrible Images of Grandeur—Open Mouths of Fire—The Earth a Seething Furnace Inside—A Lighthouse in the Eolian Islands—Dull Thunders Shaking Mountains—A River of Fire Thirty Miles Long—Violent Eruption of Mauna Loa—A Scene of Appalling Sublimity—Jets of Fire and Smoke a Thousand Feet High—Connection Between Earthquakes and Volcanoes—Hoffman's Vivid Description of Fiery Stromboli—A Volcano Bursting out of the Sea—Graham's Island in Conflagration—A Party Caught by a Deluge of Ashes and Hot Stones—Cities Buried Under Floods of Lava from Vesuvius—Remarkable Asiatic Volcanoes—A Strange New Zealand Tradition—The Sea Boiling and Driven Back.

EEN from afar, volcanoes only give a very imperfect idea of what they are. To appreciate their phenomena and their ravages, our eyes must survey their depths. All is then changed, and the grandeur of the spectacle strikes the imagination, graving terrible images upon it. We are astonished at the immensity of their fire-spouting mouths, and at the vastness of the lava streams which flow from them at certain times. Some men of science have expressed their wonder that the interior of the earth can furnish matter sufficient for these eruptions, but a little reflection will show that no great contraction of the crust of the globe is required to feed them. Violent eruptions do not usually emit more than 1300 cubic yards of lava, and seldom so much. This quantity, supposing it spread equally over the surface of the globe, would not form a layer so much as the ten-thousandth of an inch in thickness. A contraction of the earth sufficient to shorten its radius half an inch would furnish matter for five hundred violent eruptions; and on consulting the history of recent volcanic phenomena we arrive at the conclusion that a contraction of one inch and a half is sufficient to have supplied the lava thrown up in all the eruptions that have occurred on our planet during the last 3000 years.

The loftier volcanoes are, the less frequent are their eruptions. The lava which they vomit forth, issuing from furnaces the depth of which is probably the same in every case, it is clear, that for the waves to mount in the chimneys of those which are very high, a much greater force is required than in others. Thus one of the smallest of all, Stromboli, is always throwing out flames; since the days of Homer it has served as a beacon to navigators approaching the Eolian Islands. On the contrary, the vol-

canoes which animate the crests of the Cordilleras, and which are six or eight times as high, seem condemned to long intervals of repose, and often only break out from century to century.

Cataracts Rushing Down the Volcano's Side.

The volcanoes which lord it over the frozen summits of the Andes often produce phenomena equally striking and unexpected. When they melt the snows which crown their craters, their eruptions produce impetuous torrents, which, precipitating themselves, bear with them smoking scorïæ, fragments of rocks, and blocks of ice. At a great distance most volcanoes look just like pointed cones vomiting flames or vapors by a very narrow fissure. But when patience and courage have carried us to the rugged crests of their burning mouths, or when we have penetrated their sides, we are astonished at the scenes of grandeur which present themselves to our eyes in the midst of these frightful and dangerous abysses, where the heat and deleterious gases threaten to suffocate the traveler. One may well feel astonished at the dimensions of the ancient craters of France and Italy, the one filled up with lakes, the other transformed into forests.

Many countries of our globe, now buried in the most perfect repose and covered with a vigorous vegetation, were, at an epoch that cannot at present be definitely fixed, everywhere convulsed by volcanic fires; rich harvests now abound where formerly rolled burning streams of lava. Ancient craters now display only grass and moss in the depths of their mouths, which formerly vomited torrents of fire. This spectacle is even met with in the centre of France, in all the mountains of Auvergne. Active volcanoes are common at the present time on the surface of the globe. But by this it is not meant that they are agitated by perpetual convulsions. Nearly all awake to their terrible activity only at long intervals, and during the space of time between the eruptions their internal toil is only revealed by slight and deceptive phenomena.

Mountains in Convulsions.

When a formidable eruption breaks out it is often accompanied by dull roars which seem to shake the mountain. In a short time the fiery mouth launches into the air sheets of flame and smoke, as well as masses of cinders and burning rock; in 1853, in one of its most terrible eruptions, Cotopaxi projected great blocks of trachyte to a distance of nine miles. During this time the lava escapes with violence from the entrails of the mountain, and pours over its sides like so many streams or cascades of fire, consuming everything in their path. In very lofty volcanoes

the lava, in order to rise to the crater in which they culminate, must require an almost incalculable force; hence it often happens that it makes its way out before reaching it, and having burst the flanks of the mountain near its base forms a small additional volcano, in which, for the future, all efforts of the eruption are concentrated, and from which pour streams of lava which we should not expect from so low an elevation.

In high volcanic mountains we often find at the base of the great cone a series of small accessory volcanoes: Etna possesses quite a family scattered over its flanks. In fact it is these that have in particular ravaged the surrounding countries. The most frightful eruption of Etna in modern times was produced by one of these young volcanoes, the Monte Rosa. From it issued the long river of lava which rolled its burning waves over a distance of nine leagues, fired a great part of Catania, and only stayed its passage when it plunged into the sea amidst a most tumultuous struggle between the waves and fire.

Great Streams of Liquid Fire.

The form of the Hawaiian volcano named Mauna Loa, is a flattened dome, and this is its most remarkable feature. The idea of a volcano is so generally connected with the figure of a cone, that the mind at once conceives of a lofty sugar loaf ejecting fire, red-hot stones, and flowing lavas. But in place of slender walls around a deep crater, which the shaking of an eruption may tumble in, the summit of the Hawaiian volcano is nearly a plane, in which the crater, though six miles in circuit, is like a small quarry hole, the ancient orifice being not less than twenty-four miles in circumference. A violent eruption of Mauna Loa took place in the year 1843, which is thus described by the Rev. Titus Coan: On the 10th of January, just at the dawn of day, we discovered a rapid disgorgement of liquid fire from near the summit of Mauna Loa, at an elevation of about fourteen thousand feet above the sea. This eruption increased from day to day for several weeks, pouring out vast floods of fiery lava, which spread down the side of the mountain, and flowed in broad rivers, throwing a terrific glare upon the heavens, and filling those lofty mountainous regions with a sheen of light. This spectacle continued till the molten flood had progressed twenty or thirty miles down the side of the mountain, with an average breadth of one and a half miles, and across a high plain which stretches between the bases of Mauna Loa and Mauna Kea. After many weeks another missionary and myself penetrated through a deep forest, stretching between Hilo and the mountain, and reached the molten stream, which we followed to the top of the mountain, and found its source in a vast crater, amidst eternal

TERRIBLE ERUPTION OF THE HAWAIIAN VOLCANO—MAUNA LOA.



snow. Down the sides of the mountain the lava had now ceased to flow upon the surface ; but it had formed for itself a subterranean duct, at the depth of fifty or one hundred feet. This duct was vitrified, and down this fearful channel a river of fire was rushing at the rate of fifteen or twenty miles an hour, from the summit to the foot of the mountain. This subterranean stream we saw distinctly through several large apertures in the side of the mountain, while the burning flood rushed fearfully beneath our feet. Our visit was attended with peril and inconceivable fatigue, but we never regretted having made it, and we returned deeply affected with the majesty, the sublimity, the power, and the love of that God who "looketh on the earth and it trembleth, who toucheth the hills and they smoke ; whose presence melteth the hills, and whose look causeth the mountains to flow down."

A Fiery Mountain of Remarkable Formation.

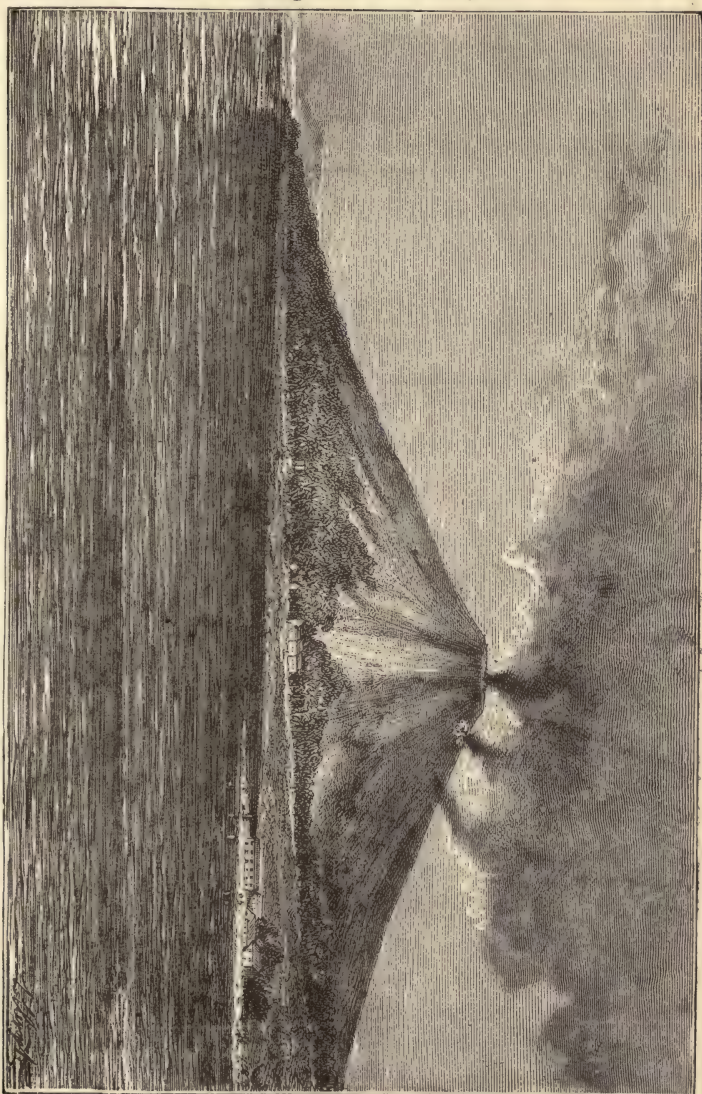
Mauna Loa presents the curious feature of having two distinct and seemingly unconnected craters—one on the summit of the mountain, and another on its flanks, at a much lower level. This last is named Kirauea, and is perhaps the most remarkable volcanic crater in the world. It was visited by Mr. Ellis, a missionary to those parts, who has given an account of it in his missionary tour. The approach to it lies over a vast tract completely covered with old lava ; and Mr. Ellis describes his visit to it in the following terms: The tract of lava resembles in appearance an inland sea, bounded by distant mountains. Once it had certainly been in a fluid state, but appeared as if it had become suddenly petrified, or turned into a glassy stone, while its agitated billows were rolling to and fro. Not only were the large swells and hollows distinctly marked, but in many places the surface of those billows was covered by a smaller ripple, like that observed on the surface of the sea at the springing up of a breeze, or the passing currents of air, which produce what the sailors call a cat's paw. After walking some distance over the ground, which in several places sounded hollow under our feet, we at length came to the edge of the great crater, where a spectacle sublime, and even appalling, presented itself before us.

A Scene of Appalling Sublimity.

Immediately before us yawned an immense gulf, in the form of a crescent, about two miles in length, from north-east to south-west ; nearly a mile in width, and apparently 800 feet deep. The bottom was covered with lava, and the south-western and northern parts of it were one vast flood of burning matter, in a state of terrific ebullition, rolling to and fro

its fiery surges and flaming billows. Fifty-one conical islands, of varied form and size, containing as many craters, rise either round the edge or from the surface of the burning lake; twenty-two constantly emitted

THE GREAT VOLCANO OF HAWAIIA IN ACTION.



columns of grey smoke, or pyramids of brilliant flame; and several of these at the same time vomited from their ignited mouths streams of lava, which rolled in blazing torrents down their black indented sides into the boiling mass below.

This great crater was also visited by Messrs. Dana and Wilkes of the United States' exploring expedition. They describe the light from the glowing lava to be so intense as to form rainbows on the passing rain-clouds. The lava appears almost as liquid as water, and its surface is agitated by waves resembling those of the sea, and breaking, like them, upon the shore formed by the bordering terraces of solid lava. Sometimes they rise to a height of between sixty and seventy feet. The lava, thus tossed into the air, cools in its descent, and falls solidified on the surface of the molten lake, like pieces of broken ice. One peculiarity of this volcano is its tendency to throw out its lava in jets to an enormous height. The lava seems to be first forced up in the interior of the mountain nearly to the top of the great crater; but instead of overflowing its brim, it opens a passage through the sides of the cone at a considerably lower elevation, so that the pressure of the liquid in the interior forces it from the orifice in a jet, whose height is in proportion to that of the inner column.

Blood-Red Rivers of Destruction.

The lava-jets thrown up from Mauna Loa during a great eruption in 1852, are estimated to have reached a height of 500 feet—those of some later eruptions double that height. The lava, as it ascends, is described as being white-hot; but in its descent it acquires a blood-red tint, and it comes down with a fearful noise. The quantities of lava ejected during some of the recent eruptions have been enormous. One stream is described as having travelled fifty miles, with an average breadth of three miles. A great stream, which burst forth from the side of the mountain in 1855, reached a distance of sixty miles from its source—burning its way through the forests, and advancing at the rate of about a mile in a fortnight. In 1859 this volcano was again in vigorous action, throwing up intermitting jets of lava to the estimated height of 800 or 1000 feet. From this great fiery fountain the lava flowed down in numerous streams, spreading over a width of five or six miles. One stream, probably formed by the junction of several smaller, attained a height of from twenty to twenty-five feet, and a breadth of about an eighth of a mile. Great stones were also thrown up along with the jet of lava, and the volume of smoke, composed probably of fine volcanic dust, is said to have risen to the height of 10,000 feet.

An eruption described as having been of still greater violence took place in 1865, characterized by similar phenomena, particularly the throwing up of jets of lava. This fiery fountain is said to have continued to play without intermission for twenty days and nights, varying only as respects

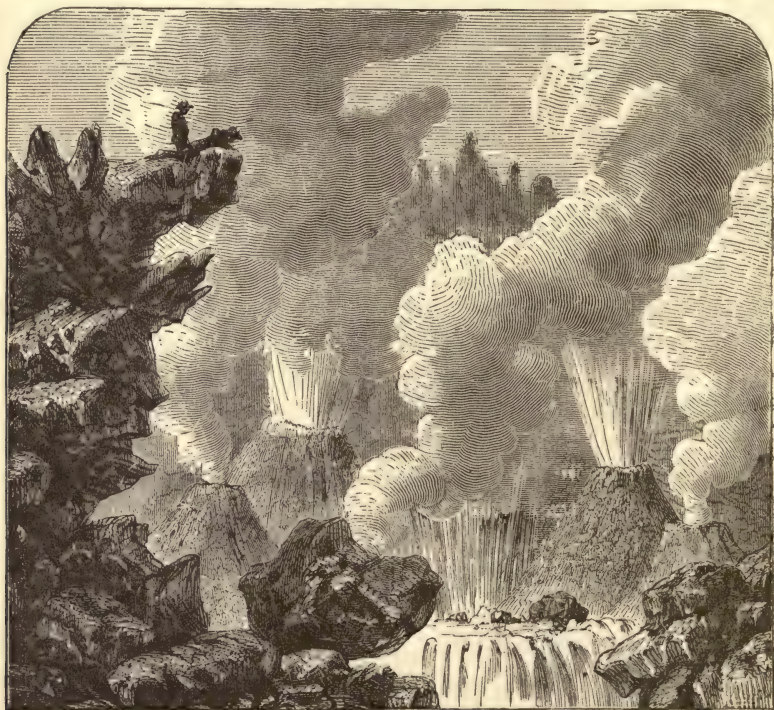
the height to which the jet arose, which is said to have ranged between 100 and 1000 feet, the mean diameter of the jet being about 100 feet. This eruption was accompanied by explosions so loud as to have been heard at a distance of forty miles. A cone of about 300 feet in height, and about a mile in circumference, was accumulated round the orifice whence the jet ascended. It was composed of solid matters ejected with the lava, and it continued to glow like a furnace, notwithstanding its exposure to the air. The current of lava on this occasion flowed to a distance of thirty-five miles, burning its way through the forests, and filling the air with smoke and flames from the ignited timber. The glare from the glowing lava and the burning trees together was discernible by night at a distance of 200 miles from the island.

In the early part of 1887, Mauna Loa was again in action, presenting startling spectacles similar to those just described. It is literally a mountain of fire, roaring and thundering, and belching out lurid flames and immense rivers of lava. This is one of the amazing phenomena which have so long rendered the group of the Sandwich Islands an object of surpassing interest to the whole civilized world. Here we find one of the great breathing places of the inside world, that tremendous furnace upon which we live. What gigantic forces, what red hot, burning materials, what awful abysses of flame and fury this world of ours holds in its deep, mysterious and unknown recesses!

Connection Between Earthquakes and Volcanoes.

The connection between earthquakes and volcanoes is so evident that it hardly admits of any doubt. But a number of facts have been collected which evidently show that there must exist a subterraneous connection between these phenomena, even when they occur at great distances from each other. Some of these facts are very interesting and curious. Stromboli, a small volcano situated on one of the Lipari Islands, which is in continual activity, and never ceases to eject volcanic matter and smoke, fell suddenly into a state of inactivity when the plain of Calabria was visited by the great earthquake. The distance between the volcano and the centre of the earthquake does not much exceed fifty miles. Humboldt mentions that for many months the volcano of Pasto had uninterruptedly continued to emit a column of thick smoke, which suddenly disappeared just at the moment when the valley of Hambato was convulsed by the earthquake which levelled the town of Riobamba to the ground. In this case the distance was two hundred and twenty miles. On the 1st of November, 1755, a whirling column of smoke ascended from the crater of Mount Vesuvius, which is commonly a sign that the volcano is in a

state of disturbance; but all at once the flow of smoke was stopped, and that which had issued reëntered the crater. The distance between Lisbon and Mount Vesuvius exceeds one thousand two hundred miles. As it is a well-established fact that the strong oscillation of the earth during the great earthquake of Lisbon extended to the centre of England, Lombardy, and the Alps, and even to Massachusetts and Pennsylvania, it can hardly be considered a bold assumption, when it is supposed that this change in the crater of Mount Vesuvius was effected by that earthquake,



FLAMES BURSTING FROM THE CRATER OF STROMBOLI.

thus showing a connection between the earth's convulsions and its volcanoes. Similar coincidences have been repeatedly observed.

When Hoffman the great Prussian geologist, ascended the peak of Stromboli, and reached the crater, he lay down and hung over its precipitous side, while held firmly by his companions. He was thus enabled to look right down into its fiery depths, and of the scene which they presented he has left on record a vivid description: At the bottom of the crater were three mouths in a state of activity. The central and principal one was 200 feet in diameter; it was in no way remarkable; it smoked

slightly, and its sides were encrusted with several coats of yellow sulphur. By the side of this main vent, but nearer the precipice, was another, only twenty feet wide, in which I observed the glow of the liquid column of lava that at intervals played upon the surface. The lava was not, as an ardent imagination depicts it, a burning mass, vomiting forth flames; but shone like molten metal, like iron flowing from the furnace, or like silver at the bottom of a heated crucible. This molten mass oscillated to and fro, and rose and sank.

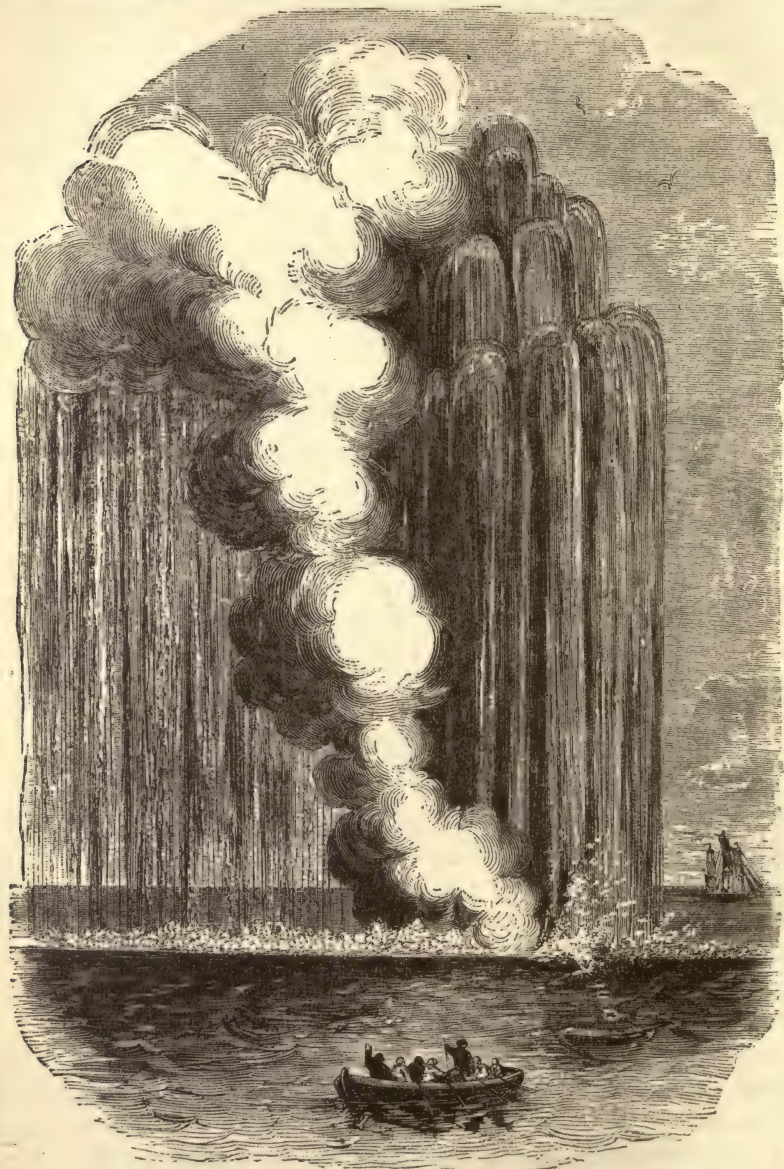
A Scene of Awful Grandeur.

The surface regularly rose and fell at rhythmic intervals. A peculiar noise was audible, like the rush of air entering by gusts through the door of a mining furnace. A cloud of white vapors rose, upheaving the lava, which fell back after each commotion. These vapor-clouds carried off the surface of the lava numerous fragments of red-hot scoria, which danced in the air as if tossed to and fro by invisible hands, in a rhythmic measure, above the edge of the opening. This regular and attractive movement was interrupted at intervals of fifteen minutes by more violent vibrations. The mass of whirling vapors then remained immovable for a moment, or even sank back a little, as if it was inhaled by the crater, from whose depths the lava surged up more furiously, as if to encounter it. Then the ground trembled, and the sides of the crater shivered as they inclined inwards. It was a veritable earthquake. From the mouth of the crater proceeded a hoarse reverberating bellow, and at the end an immense balloon of vapor grew on the surface of the lava rising up with a sonorous and thundering clash. The whole surface of the lava splintered into fragments was then ejected into the air. The heat now became insupportable; and a sheaf of flames shooting suddenly upwards, fell back in a fiery rain on the surrounding district. A few balls rose to a height of 1200 feet, and described, as they swept over the heads of Hoffman and his companions, parabolic curves of fire. Immediately after each of these explosions, the lava retired into the bottom of the crater, which yawned like a black and awful gulf; but speedily its glittering surface rose again, and recommenced its ordinary rhythmic play.

Volcanic Mountains Bursting from the Sea.

The most remarkable phenomenon produced by the concurrence of earthquakes and volcanic agency is the emerging of new islands from the sea. They rise suddenly, and their appearance is attended with nearly all the phenomena accompanying eruptions; they exist for some time, and then they commonly disappear gradually. It is a circumstance worthy to be noticed, that such islands make their appearance repeatedly on the

same spot, and that such spots may be pointed out in each of the volcanic systems of Europe, and have been repeatedly discovered.



VOLCANO UNDER THE OCEAN NEAR THE AZORE ISLANDS.

In the volcanic system of the Azores the spot where the volcanic islands appear is about a mile west of the western extremity of the Island

St. Michael. An island has risen there above the sea at different periods—in 1628, in 1720, and 1811. It has been considered as a remarkable fact, that about ninety-one or ninety-two years have passed between the reappearances of the island. Respecting the phenomena which attended the first appearance of the island nothing is known; but the second in 1720 was preceded and attended by a very high column of smoke, and the ejection of ashes and pumice stone. Its declivities were very steep, as at a short distance from its shores no ground was found at a depth of twenty fathoms. Its elevation was estimated at about three hundred and fifty feet above the sea level. After two years it disappeared.

A Startling Spectacle.

In 1811 the formation of the island was preceded by severe and numerous shocks on the north-western side of St. Michael. Before these shocks ceased, a column of smoke rose out of the sea, within which, from time to time, large masses of black cinders, sand, and ashes were observed rising, accompanied by frequent flashes of lightning and a noise like thunder, which was compared to a continual firing of guns and muskets. In a short time a black body was perceived to form the base of the column, and was soon recognized as the upper border of a crater-formed rock, rising from the sea, which, on the fourth day after the beginning of the phenomenon, formed a coherent mass. This mass increased, by the addition of new matter, and in less than a month had attained its largest dimensions. The eruptions of matter then ceased, and a landing could be effected on the shores of the island. The island had nearly the form of a circle, and was about a mile in circuit. Its greatest elevation above the sea level was estimated at about three hundred feet. In the middle was a circular crater, which, by an opening across the solid mass, communicated with the sea, from which water, in a high state of ebullition, was continually and rapidly flowing. The declivities of the island towards the sea were very steep, and the sea round it deep; for at a distance of twelve or fifteen yards it was more than fifteen fathoms deep. Captain Tillard, who had witnessed its formation from the adjacent shores, called this island Sabrina, after the name of the vessel under his command; and furnished a full description of its sudden and extraordinary appearance.

In the Mediterranean, near Sciacca, on the south-west coast of Sicily, there occurred, in 1831, a submarine eruption of a very interesting kind. The inhabitants of Sciacca had experienced several slight shocks of earthquake. John Corrao, the captain of a Sicilian vessel, perceived rising out of the sea, at a spot distant about thirty miles south-west of Sciacca,

an immense jet of water, which was thrown up with a thundering noise to a great height, at intervals of about a quarter of an hour. This jet produced a thick mist, that soon spread itself over the sea, which was very rough at the time. The surface of the water ere long became covered with a reddish scum, and many dead fishes were seen floating about. On passing near the spot two days afterwards, Corrao found the jet still playing, and he estimated its height to be about sixty, and its diameter upwards of eight hundred feet. The cloud of vapor from the jet rose, according to his estimate, to between twenty and thirty times the height to which the water ascended.

An Island Upheaved from the Mediterranean.

All this while a thick mist veiled the horizon from the inhabitants of Sciacca; but later they perceived the air to be pervaded by a strong sulphurous smell, and they saw drifting toward the shore great quantities of black dross, which accumulated on the beach. Multitudes of dead fishes were also seen floating on the water. On the following day they beheld, rising out of the sea, at the spot before indicated, a great column of what seemed by day like black smoke, but which by night became illuminated by the glare of fire glowing from beneath. Bright scintillations were also perceived to be thrown up amid the smoke, and loud reports, as if from heavy ordnance, were occasionally heard.

Not long afterward, while sailing near the spot where these phenomena had been seen, Corrao discovered that there had been upheaved an island, from nine to twelve feet high, having in its centre a crater whence jets of vapor and clouds of volcanic ashes were being thrown out. Towards evening, the same day, a small English boat despatched by Admiral Hotham approached the place, and found the height of the island increased to upwards of seventy feet, and its circumference to nearly three-quarters of a mile. The sea all round was covered with dross of a chocolate-brown color, and in the interior of the crater there was a small lagoon, communicating with the sea by a narrow channel. The water in the lagoon was reddish. Only a few years before this event, soundings had been taken close to this spot, and the depth was found to be one hundred fathoms.

The scene of these extraordinary phenomena was visited by Captain Swinburn, of the Royal Navy, and Hoffman, the Prussian geologist. They could not approach nearer the island than two miles, so great was the agitation of the sea, and such the quantity of dross being thrown out by the volcano. Even at that distance some of the glowing stones fell into their boat. According to their observations, the diameter of the

crater appeared to be about 600 feet, and the island was augmenting from moment to moment by the accumulation of ejected matters, which for the most part fell near the place whence they were thrown up. There rose from the crater a column of aqueous vapor mixed with volcanic substances to the height of 1800 feet. Occasionally quantities of black dross were thrown up in the midst of this column; but, what was more striking, there rose during their observations a vast column of thick black smoke, which was shot up with great violence to the height of about 600 feet, and then spread itself into a form resembling a huge pine-tree. In the midst of this dark column, glowing stones were frequently tossed up



VOLCANIC ERUPTION AT GRAHAM'S ISLAND.

to great heights, accompanied by a noise like the rattling of hail. Eruptions of this sort continued for periods varying from ten minutes to an hour, and were separated by intervals of rest, during which the aqueous vapors ascended in perfect silence.

The annexed engraving, copied from a sketch by Kellin, an Italian artist, shows the appearance presented by the island during the eruption. It attained, at its highest point, an elevation of about 200 feet, while its circumference increased to about three miles. This remarkable volcano, which is known as Graham's Island, did not long maintain its position above water. It was finally reduced nearly to the level of the sea, and

not long afterwards it disappeared altogether. When soundings were taken, there was found a dangerous reef where the island had been. It is composed of a central mass of black rock, surrounded by banks of sand and volcanic stones—the highest point of rock being only nine feet under water. More recent soundings show that this shoal remains in the same state.

Far-Famed Vesuvius.

Of the two hundred active volcanoes, or thereabout, which are scattered over the face of the globe, the most interesting are those constituting the Mediterranean group. Vesuvius, by reason of its remarkable associations, and its being the only active volcano on the European continent, invites our attention. For many long ages prior to A. D. 79, Mount Vesuvius had existed as an extinct volcano, retaining, however, some traces of its having been once in a state of activity. It was a mountain of large dimensions, but of moderate height. Its sides were clothed with gardens and vineyards, presenting a most luxuriant vegetation. Strabo describes it as surrounded by beautiful farms of great fruitfulness, and richly wooded except at the top, where it was flat and barren, and where the slaggy appearance of the stones led him to suspect there had once been a burning crater. The dangerous character of the mountain, however, was generally so little suspected, that besides many villas, the cities of Stabiae, Herculaneum, and Pompeii, had been erected at its base, and their inhabitants had dwelt for many generations in undisturbed security.

It was not until the year A. D. 63 that any alarm was excited in the minds of those dwelling in the neighborhood of Vesuvius. In that year, however, both the mountain itself and all the country around it were shaken by a violent earthquake, which overthrew a considerable number of houses in the cities. This convulsion was succeeded by about sixteen years of profound repose, during which the houses that had been thrown down were in the course of being rebuilt.

First Great Eruption.

On the 24th of August, A. D. 79, occurred the first great recorded eruption of Mount Vesuvius. A vivid description of it has been fortunately handed down to us, in a letter addressed to Tacitus by the younger Pliny. His uncle, the elder Pliny, was at the time in command of the Roman fleet at Misenum, where he had with him several members of his family, including his nephew. It was from this point that the eruption was first descried. They saw rising from the top of the mountain what seemed to them like a column of dense black smoke, but which was in reality a great volume of dust, ashes, and stones, thrown up by the force

of vapors rushing from the vent which had been opened in the volcano. Pliny likens it to a tall pine-tree throwing out great branches at its top.

Struck with wonder at this phenomenon, the elder Pliny, a man of phil-



TERRIBLE ERUPTION OF MOUNT VESUVIUS.

osophical spirit and inquiring mind, hastened with a party towards the shore, that he might land and examine more narrowly this remarkable convulsion of nature. He first steered for Retina, the modern Resina, but

was prevented from landing there by tremendous showers of ashes and hot stones, and by the sudden retreat of the sea. He then made for Stabiae, where he disembarked, and hastened to the house of his friend Pomponianus. Here he remained till the evening, occasionally gazing at the mountain, and exerting himself to allay the fears of those around him. As night drew on, streaks of fire were seen here and there on the mountain side, which he attributed to the burning of the woods and villages; but to show how little he was personally apprehensive of danger, he retired to his chamber, and ere long dropped asleep.

Trying to Escape a Shower of Falling Stones.

Meanwhile the fall of stones and ashes in Stabiae itself waxed fast and furious. The inner court of the villa was becoming rapidly filled, and Pliny's servants, now fully alive to the imminence of the danger, roused their master, who immediately joined his friend Pomponianus, whom he found with his family and household already assembled around him. The party now consulted together as to the best course to be pursued; and perceiving the probability of the villa being buried ere long in the stones and ashes, they resolved on endeavoring to effect their escape. Tying pillows on their heads with napkins, to shield them from the falling stones, they sallied forth. Although it was morning, the darkness was deeper than that of midnight, and they had to grope their way through the laden atmosphere by the light of torches. They succeeded in gaining the beach, with the intention of escaping by water; but the sea was so tempestuous, as to render embarkation impossible. His servants spread a sail-cloth for Pliny, who lay down to rest. But presently flames and sulphurous vapors rose from the ground and dispersed the party. By the help of two of his servants who remained with him, Pliny succeeded in rising: but he had scarcely attained his feet, when he fell down dead, being overpowered by the suffocating vapors.

Cities Buried and Destroyed.

The cities of Stabiae, Herculaneum, and Pompeii, were entirely buried under the immense mass of ashes and stones, thrown out by the mountain during this dreadful eruption. So suddenly did the fatal shower come upon them, that many of the inhabitants perished in their dwellings or in their streets. No lava was ejected from the mountain on this occasion; but it is suspected that, along with the ashes and other loose materials, there was a considerable eruption of fluid mud. For, while Pompeii was buried only in ashes and loose stones, Herculaneum is entombed in a much more consistent substance, which has evidently been once in a plastic condition, and which appears to be composed of volcanic

ashes cemented by mud. This former plasticity is proved by the casts of statues and masks which have been found here. The showers of volcanic ashes, dust, pumice, and stones, continued to fall on those devoted cities for eight successive days, accompanied by torrents of rain, which would doubtless tend to unite together the loose materials.

It is a remarkable fact that the volcanic ashes from Pompeii, on being examined under the microscope by Ehrenberg, were found to contain a large proportion of little shells. This curious circumstance raises a probability that the mountain, previous to the eruption, had been very extensively cavernous, and had contained large collections of water, in which the diatoms had been profusely propagated, forming enormous beds, which were thrown out from the summit as fine dust by the force of the elastic vapors acting from beneath. Possibly, however, the deposits of these shells may have been formed at the bottom of the sea, in the neighborhood of the mountain, and been forced into the volcanic focus along with the seawater, whose sudden conversion into explosive steam, through contact with highly heated materials, may have caused the eruption.

Digging for Lost Cities.

It was not until the year 1713 that any traces were obtained of the buried cities; and notwithstanding the greater thickness of the overlying masses, it was Herculaneum that was first discovered. In the course of that year a well was being sunk, and the workmen, to their surprise, came right down upon the theatre, where they soon after found the statues of Hercules and Cleopatra. Owing to the difficulty of cutting through the superincumbent materials, and the stiffness of the substance in which the buildings are embedded, but little progress has been made in the disinterment of this city, in comparison with what has been done at Pompeii, whose site was not discovered till forty years afterwards. Of the latter city a large proportion has been laid open, and the entire circuit of the walls ascertained to be three miles, so that its population must have been considerable. Many of the public buildings and private houses have been exposed, and their valuable contents removed to a museum in Naples devoted to the purpose. Some whole streets have been cleared; and among other places of interest the cemetery of Pompeii has been located.

There are a few volcanoes on the continent of Asia, and many more in its adjacent islands. In Kamtchatka there are several, which have been in eruption at no distant period. One of them which is 15,000 feet in height, consequently covered with snow and glaciers, had a great eruption in 1829. Within 700 feet of the summit, there was formed a crater which poured forth an immense torrent of lava. Its progress was for a

time arrested by the snow and glaciers ; but the glowing mass at length became so great that it burst through this barrier with a horrible roar, and came thundering down the steep declivity of the mountain. The noise was heard at a distance of fifty miles. But it is in the Asiatic Islands that volcanoes are both most numerous and most active. Among the nearest to the mainland is Barren Island, in the Bay of Bengal, to the southward of the coast of Pegu. The whole of this island seems to be nothing else than a large volcanic crater. The walls, on their outer sides, rise from the sea with a moderate ascent ; but on the inner side they are nearly perpendicular, and enclose a circular basin, into which the sea finds access by a breach. In the centre of this basin rises a volcanic cone, about 500 feet in height, which is frequently in action.

A Mountain Swallowed Up.

Java is most remarkable for the number of its active volcanoes, distinguished by the great quantity of sulphur and sulphurous vapors which they discharge. There are in Java no less than thirty-eight volcanoes which have been known to be in activity, and one of them attains a height of 10,000 feet. In 1772 there was a great eruption of the volcano named Papandáyang, during which a large portion of that mountain, formerly one of the highest in Java, was swallowed up. The following is the narrative of this event, given by Horsefield: The account which has remained on record asserts that, near midnight there was observed about the mountain an uncommonly luminous cloud, by which it appeared to be completely enveloped. The inhabitants, as well about the foot as on the declivities of the mountain, alarmed by this appearance, betook themselves to flight ; but before they could all save themselves, the mountain began to give way, and the greatest part of it actually fell in and disappeared in the earth. At the same time a tremendous noise was heard, resembling the discharge of the heaviest cannon. Immense quantities of volcanic substances, which were thrown out at the same time and spread in every direction, propagated the effects of the explosion through the space of many miles.

It is estimated that an extent of ground, of the mountain itself and its immediate environs, fifteen miles long and fully six broad, was by this commotion swallowed up in the bowels of the earth. Several persons, sent to examine the condition of the neighborhood, made report that they found it impossible to approach the mountain on account of the heat of the substances which covered its circumference, and which were piled on each other to the height of three feet ; although this was fully six weeks after the catastrophe. It is also mentioned that forty villages,

partly swallowed up by the ground, and partly covered by the substances thrown out, were destroyed on this occasion, and that 2957 of the inhabitants perished. A proportionate number of cattle was also destroyed; and most of the plantations of cotton, indigo, and coffee, in the adjacent districts, were buried under the volcanic matter.

New Zealand, we may remind the reader, consists of two large islands and one small, named respectively North, Middle, and South Island. They are of volcanic origin, and a great portion of their area is occupied by a few active and several extinct volcanoes. In North Island the vol-



A UNIQUE CLUSTER OF VOLCANIC CRATERS IN NEW ZEALAND.

cano of Tongariro is 6000 feet high, and constantly emitting clouds of smoke. Tongariro is not an isolated conical mountain; on the contrary, it is rather a very complicated volcanic system of powerful and still active cones. No accounts have ever been given of any of the natives ascending Tongariro; the dread of the infernal powers seems to have diverted them from such a design. To the south of Tongariro rises Ruapahou, the bases of the two mountains blending into one another by an imperceptible incline, and forming a kind of table-land about ten miles broad. On this table-land lie four lakes, two of which are about three miles across; the others considerably smaller. One of them is named Taran-

aki; the river to which it gives birth empties its waters into the Whanganni, and a singular tradition attaches to this lake.

The natives tell you that the mountain Taranaki formerly stood, like a third giant, by the side of Tongariro and Ruapahou. They remained on friendly terms, as giants should, until Taranaki attempted to carry off Pihinga, the wife of Tongariro. Thereupon the latter quarreled with him, and dealt him a blow on the head which made him fly. He descended the course of the Whanganni, and following the deep chasm of that river, approached the sea, where to-day he rears his colossal but solitary bulk near the coast. During his journey, a couple of fragments detached themselves from his forehead; and to-day, by way of proving the truth of their story, the natives point out two masses of rock, differing from the volcanic formations around the Whanganni, which are found at about eighteen miles from its source.

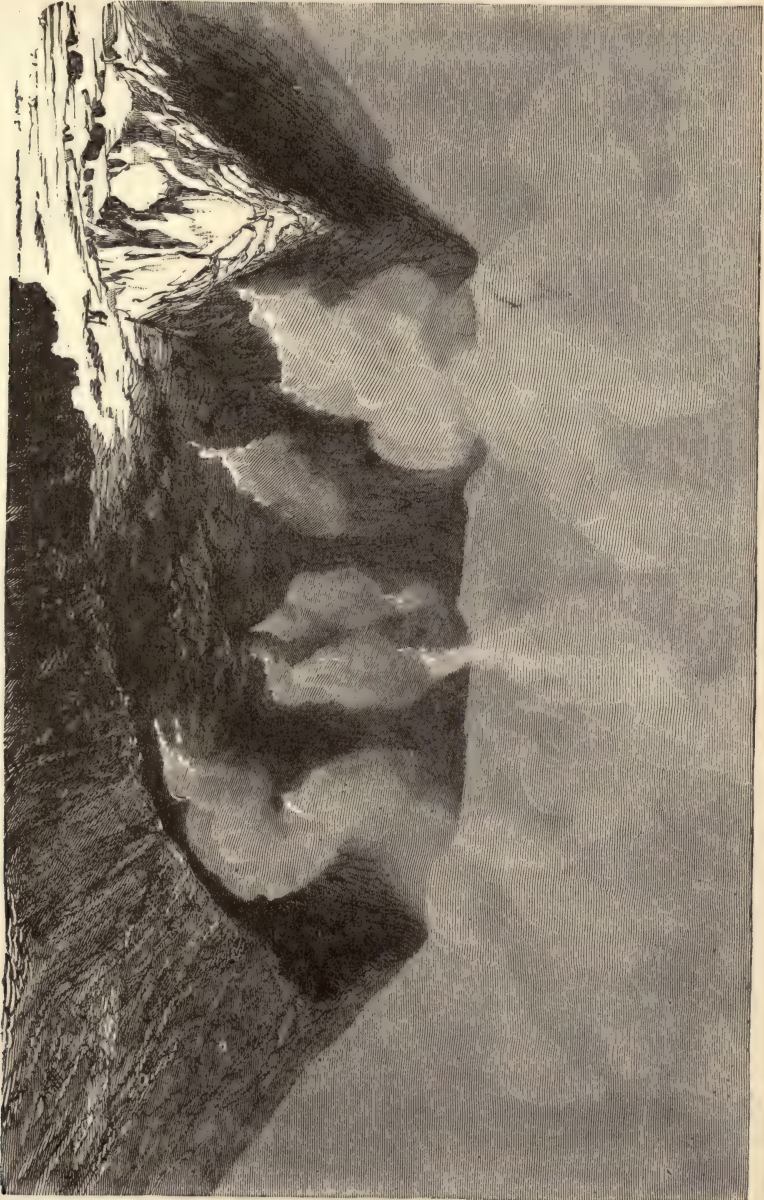
Occasionally a very loud report, similar to the firing of a cannon, attended with a flash of lightning, is heard to proceed from a stream of lava. This happens when the lava runs over a swampy ground or a very moist soil. The conversion of the water into steam, and its decomposition, produce a commotion which for some moments is able to stop the progress of the stream. The steam breaks with great noise through the mass, tears asunder the crust of scoria which envelops it, and throws both the lava and the scoria into great confusion. As a portion of the steam is decomposed, the hydrogen explodes, and produces the loud report above mentioned, with the accompanying flash.

The Ocean Made to Boil.

The influx of the running lava into the sea has given occasion to many elevated poetical descriptions. It is represented as an awful spectacle, as a struggle between two inimical elements. But in all these pictures the event is much exaggerated, though the facts which give rise to them are true to a certain extent. When the hot lava reaches the sea, the water with which it comes into immediate contact is suddenly raised to the boiling temperature. It is consequently converted into steam, which process is attended with a loud, hissing sound. But as by the conversion of the water into steam a great quantity of caloric is absorbed, the cold which is thus generated speedily converts the surface of the glowing mass into a thick and solid crust, by which all communication between the liquid lava and the sea is directly intercepted. Then the sea water sinks, of course, below the boiling point. The hardened lava is, however, pushed farther into the sea by the succeeding masses, and thus the sea is compelled to recede. In this progress the lava frequently splits; but in

the same moment the aqueous vapors issue from the rent with such a violence that the water is prevented from penetrating into its recesses.

THE SMOKING CRATER OF VESUVIUS.



Whilst this process is in action the water becomes turbid to some distance from the lava, and fish which chance to be in the vicinity are killed.

The masses of lava which are thus protruded into the sea are sometimes of very considerable dimensions. At the eruption of Mount Vesuvius in 1794, a stream of lava, after destroying the town of Torre del Greco, entered the sea, and drove it back to a distance of three hundred and eighty feet from its former shores. The width of this mass is, according to an exact measurement, twelve hundred and four feet. It is elevated fifteen feet above the sea, and is believed to have an equal depth under water. The lava, therefore, which entered the sea during this eruption, forms a mass of more than thirteen millions of cubic feet. The streams of lava flowing from Mount Vesuvius which have reached the sea are numerous, as may be inferred from the fact that the eastern shores of the Bay of Naples for about ten miles are formed by a succession of promontories composed of lava. The same observation applies to the eastern shores of the Island of Sicily, where the coast for a distance of more than thirty miles consists of high cliffs of lava, with only a few spots between them of low tracts of moderate extent covered with a soil deposited by the sea. At some places these lava cliffs are more than fifty feet high.

In the published accounts of eruptions we find that particular care has been taken to notice the velocity with which the stream of lava advanced. By comparing these statements it is found that the difference in this respect is very great. As an instance in which lava ran with extraordinary rapidity, that of Mount Vesuvius in 1794 may be adduced. This stream of lava took only six hours to run from the spot of the eruption to the sea, a distance of more than four miles. Much greater still was the velocity of that stream which, in 1804, broke out from the southern declivity of Mount Vesuvius. It is said that it moved with the rapidity of wind. In a few minutes it had reached the vineyards; and an author asserts that in four minutes it passed over a space of three-quarters of a mile in length, though the slope over which it ran was very gentle.


Since the commencement of the present century the eruptions of Vesuvius have been frequent, and sometimes of long continuance. During one eruption there was observed a peculiar phenomenon—the vapors issuing from the crater presenting three distinct colors, green, white and black. Another eruption was ushered in by the tumbling down of the principal cone, which had attained a height of upwards of 600 feet. It fell with a dreadful crash, and on the following evening there commenced an eruption which lasted continuously for twelve days. The internal detonations of the mountain were terrific; while the quantity of ashes and other matters thrown out darkened the noon into midnight.



CHAPTER V.

ADVENTURES AMONG STRANGE PEOPLE.

Beautiful Islands Long Veiled in Mystery—The First Voyage Around the World—Zoological Gardens—The Natives of the Pacific Isles—Various Types of Savages—The Remarkable Island of New Zealand—Life Among the Maories—Weapons of War—A Fighting Race of Men—An Exciting Episode—Wicked Treachery—Hideous War Dances—Queer Performances of an Old Chief—Children Imitating the Art of War—Savage Cannibalism—Tragic Death of a Blind Queen—A Chief in War Costume—Witches and Witchcraft—A Native Priest—Huge Wooden Idols—The Sandwich Islands—Beauty of the Women—Expert Swimmers—Extraordinary Feats of Surf-Swimming—The Dagger that Killed Captain Cook—A Splendid Race of Savages—Kamehameha Catching Spears—The Marquesans—Elegant Tattooing—A Chief Decorated from Head to Foot—The Puncturing Needle.

T is strange to think of the time when the vast tract of water which we call the Pacific Ocean, and which covers nearly half the globe, with all its wonderful and beautiful islands, was unknown to the civilized world. Yet it was only in the year 1513 that its existence was discovered by a Spaniard of the name of Balboa. This brave and patient man made his way, with the utmost toil and peril, on foot, across the isthmus which separates the Atlantic from the Pacific Ocean, and having been assured by his Indian guides that the sea was to be seen from a certain mountain, he climbed it all alone, and, when he reached the top, there sure enough lay the broad ocean on the other side, its calm waters glittering in the sun, and stretching away and away—who could say where? No wonder that Balboa fell on his knees in the solitude, and thanked God for having guided him to make so great a discovery.

When he at last gained the shore on the other side of the mountain, he plunged at once into the water, with his drawn sword in his hand, and took possession of it in the name of his king, Ferdinand of Spain. And that was the beginning of the discoveries of all the treasures and wonders of the Pacific Ocean, with its countless islands and strange inhabitants.

Seven years after Balboa's journey, Magellan, a Portuguese, discovered the straits which now bear his name, and, passing through them, first launched a European ship in the Southern Sea. On he sailed,

across the immense tract of calm, untraversed water, he knew not whither. How amazed the sea-gulls and the flying-fish must have been at the sight of the great strange object, making its way across the blue expanse! Perhaps they took it for some gigantic bird, with huge white wings and an enormous appetite, and fled in terror. One would think even the little rippling waves themselves must have been astonished at such a new sensation as that of a ship cleaving its way among them.

The First Voyage Around the World.

Magellan discovered the Ladrone, and afterwards the Philippine Islands. His ship, the *Victory*, performed the first voyage ever made round the world; but the great discoverer himself never received the thanks and praise of his king and country, which he had so justly earned. He was killed by the natives in one of the Philippine Islands. Afterwards various Spanish, Dutch, and British navigators followed Magellan's adventurous course across the waters of the Pacific, and discovered other islands of the Polynesian Group, so named from a Greek word signifying "many islands." But the most important and extensive discoveries in this region were not made till the latter part of the last century.

It is curious to remember that only some hundred and fifty years ago many lands whose names are now so familiar to us were as unexplored, and, indeed, unknown to the civilized world, as the countries in the moon, if there are such, are now. Many birds and beasts which we may now see any day in the Zoological Gardens had never entered the imagination of an American. Flowers and creepers now common in our gardens and green-houses were utterly unknown. William Penn would have been as much astonished if he had been shown a kangaroo as we should be now if we met Alice in Wonderland's "Mock Turtle." Our great navigators and explorers have brought many new objects of interest and beauty within our reach, and have added to the comforts and luxuries of our lives in all sorts of ways; but what far more wonderful changes the arrival of the white men and their ships have brought to the new lands themselves, and their more or less savage inhabitants! We have taught them and brought them a thousand good and useful things. It is sad to think that we have also taught them things that are neither good nor useful, and given them things which can only do them harm.

A Beautiful Island.

Of the many beautiful islands in the Pacific Ocean, New Zealand has perhaps the greatest interest for us. If we look at the globe, we shall see that it is on the other side of the world, still if we could land there to-morrow we should probably feel more as if we were in our own coun-

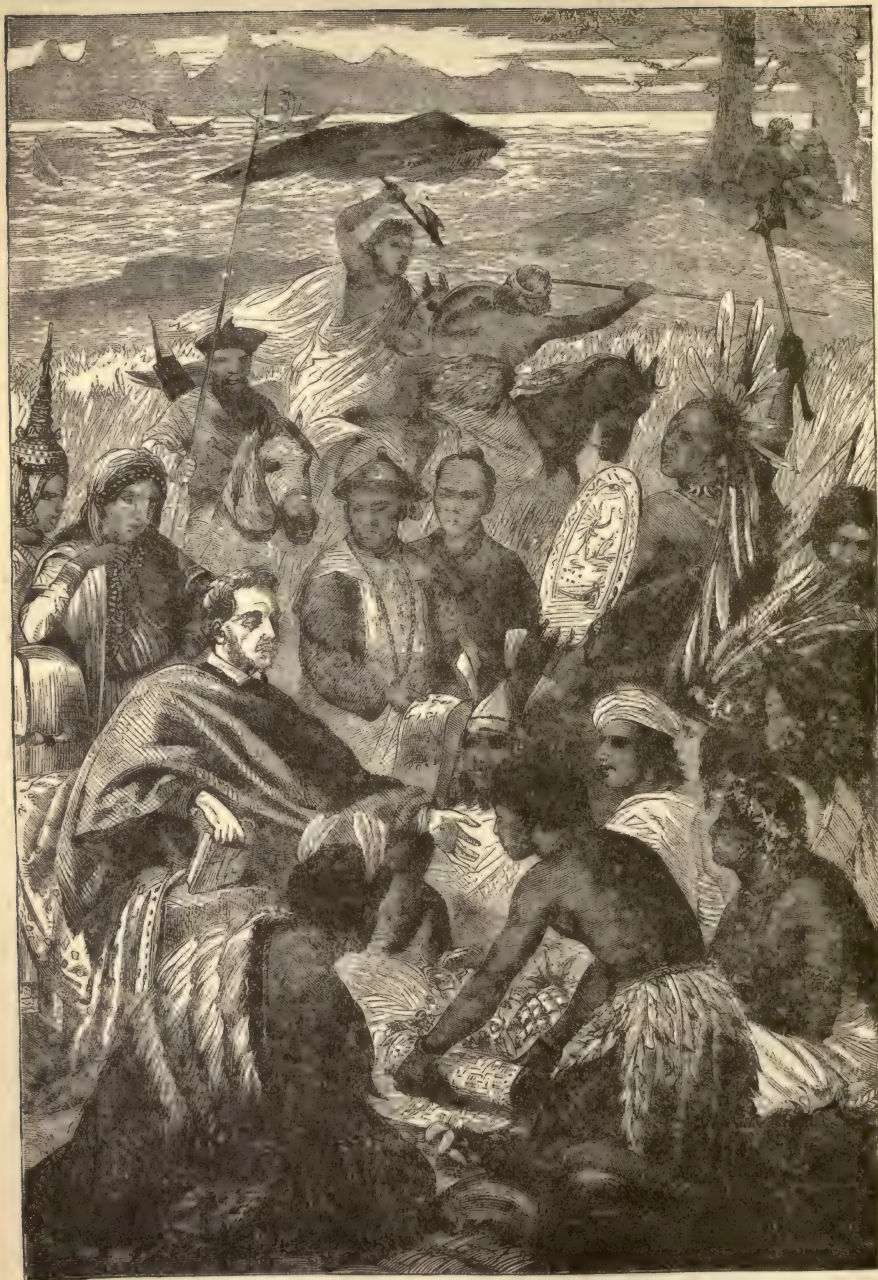
try than we should do if we visited any other part of the world, so completely have Europeans filled it with their own people, plants, and animals, and built towns and villages almost like those in their own land. The climate, too, is in some respects like our own, but warmer and finer, and the atmosphere is clear and bright, and the sky very blue. There is a slight dampness in the air, owing to the water by which it is surrounded, but which keeps the foliage and the grass green and luxuriant.

Of all the islands in the world, New Zealand is surrounded by the largest extent of water. The great Pacific Ocean stretches away in an unbroken sweep, on the east to South America, on the west to Australia, and north and south to the arctic and antarctic regions. The nearest land to it is, on one side the great island of Australia, about a thousand miles off, and on the other the beautiful South Sea Islands, many of whose foundations are so marvelously reared from the depths of the ocean by myriads of tiny coral insects. New Zealand was first discovered in the year 1642, by the famous Dutch navigator Abel Tasman; but the natives would not allow him to go on shore, and nothing was really known about it till Captain Cook landed there, more than a hundred years later.

Captain Cook Among the New Zealanders.

Though so near Australia, it is strangely unlike it in its climate, in its plants and animals, and above all in its natives; for while the Australian aborigines are one of the lowest of all savage tribes in appearance and mode of life, the Maories of New Zealand, supposed to have come originally from the Malay race, are a fine, intelligent tribe of men, and perhaps, in the condition in which we first found them, the most civilized in their way of living of any savage people. Captain Cook found them living together in villages, in huts made of wood and reeds. They wore clothing woven from the native flax, and dyed with bark, and they made stone weapons, and instruments of various kinds, and cooked their food. They also cultivated the land, and made laws about property, and stored provisions against bad times. Being much given to fighting among themselves, they made forts and defences of the most ingenious kind. Though they had no written language, they had all sorts of songs and proverbs, handed down from generation to generation.

The one great object of a Maori's life is war. In those parts of the world, where missiles, such as bows and arrows or spears are the principal weapons, war becomes a series of skirmishes, each individual trying to conceal himself as much as possible from the enemy, and to deal his own blows without exposing himself to retaliation. But when the weapons



REPRESENTATIVE TYPES OF PACIFIC ISLANDERS.

are of a nature that necessitates hand-to-hand combat, warfare naturally assumes a different aspect, and, if the forces be at all disciplined, more resembles the war of civilized nations than the independent single combats which represent war in most savage countries.

A Singular Welcome to a Friend.

In former days the Maori warriors used to employ the spear, but that weapon is now more rarely used. A few specimens are still retained, but they are intended, not to be used against an enemy, but in welcoming a friend, the chief who receives his guests pointing the spear at them, and throwing it toward them, as an evidence of his peaceful disposition and hospitable feeling. The first and most important weapon is the merai, or short club. This weapon is exactly analogous to the short sword used by the ancient Romans, and in some cases resembles it so closely that if the cross-guard were removed from the sword and the blade rendered convex instead of flat, the shapes of the two weapons would be almost exactly identical. When a Maori fights with the merai, he does not merely strike, his usual movement being to thrust sharply at the chin of the enemy; and if he succeeds in striking him with the point, he cuts him down with the edge before he can recover himself.

Savage Treachery.

Before the fierce and warlike character of the New Zealanders was known, they took several vessels by the use of the merai. It was easy to suspend the short club over the shoulder, where it was hidden by the mat, so that when a party of natives came on board, apparently unarmed, having ostentatiously left their spears and other weapons in their canoes, each man was in fact armed with the weapon that he most trusted. The plan pursued was, that the Maories should mingle freely with the crew, until each man was close to one of the sailors. At a signal from the chief, the concealed merai was snatched from beneath the mat, and in a moment it had crashed through the head of the selected victim.

Even after this ruse was discovered, the ingenious Maories contrived to get hold of more than one vessel under pretence of exhibiting their war dance, which in a moment was changed from the mimicry of battle into reality, the warriors leaping among the spectators and dealing their blows right and left among them. Ship-taking seems, indeed, to be a proceeding so dear to the New Zealander, that he can scarcely resist the temptation when it is offered him. In Tyerman and Bennet's "Missionary Voyage" there is an anecdote of an adventure that befell them, which, but for the timely aid of a friendly chief, would undoubtedly have had a tragic issue.

The ship had arrived off New Zealand, and while at anchor the following events occurred: This morning our little vessel was surrounded with canoes, containing several hundreds of the natives, of both sexes, who presently climbed up, and crowded it so much that we were obliged to put a bar across the quarter-deck, and guard it from intrusion. The commerce in various articles, on both sides, went on pretty well for some time, till one provoking circumstance after another occurred, which had nearly led to the seizure of the ship and the loss of our lives. In the confusion occasioned by the great throng in so narrow a space, the natives began to exercise their pilfering tricks, opportunities for which are seldom permitted to slip away unimproved. Suddenly the cook cried out, "They have stolen this thing;" but scarcely had he named the thing (some kitchen article), when he called out again, "They have stolen the beef out of the pot!" and then a third time, "They have stolen my cooking pan!" Presently another voice bawled out from the fore-castle, "Captain! they have broken open your trunk, and carried away your clothes!"

Up to this time we had been in friendly intercourse with the chiefs, rubbing noses, and purchasing their personal ornaments and other curiosities, suspecting no mischief. But now, in the course of a few moments, without our perceiving the immediate reason, the whole scene was changed. We found afterward that the captain on hearing of the audacious thefts above mentioned, had become angry, and while endeavoring, rather boisterously, to clear the deck of some of its intruders, one of them, a chief, on being jostled by him, fell over the ship's side into the sea, between his own canoe and the vessel. This was seized instantaneously as the pretext for commencing hostilities. The women and children in the course of a few minutes had all disappeared, leaping over-board into their canoes, and taking with them the kakaous, or mantles of the warriors. The latter, thus stripped for action, remained on deck, of which, before we were aware, they had taken complete possession, and forthwith made us their prisoners.

Threatened with Instant Death.

Tremendous were the bawlings and screechings of the barbarians, while they stamped and brandished their weapons, consisting principally of clubs and spears. One chief with his cookies (his slaves) had surrounded the captain, holding their spears at his breast and his sides, on the larboard quarter of the vessel. The chief who, with his gang, had been trafficking with Mr. Bennet, now brought his huge tattooed visage near the white trader, screaming, in tones the most odious and horrifying: "Tongata, New Zealandi, tongata kakino?" This he repeated as rapidly

as lips, tongue and throat could utter the words, which mean, "Man of New Zealand, is he bad man?" Happily Mr. Bennet understood the question (the New Zealand dialect much resembling the Tahitian); whereupon, though convinced that inevitable death was at hand, he answered, with as much composure as could be assumed, "Not bad; the New Zealander is a good man;" and so often as the other, with indescribable ferocity of aspect and sharpness of accent, asked the same question, which might have been a hundred times, the same answer was returned.

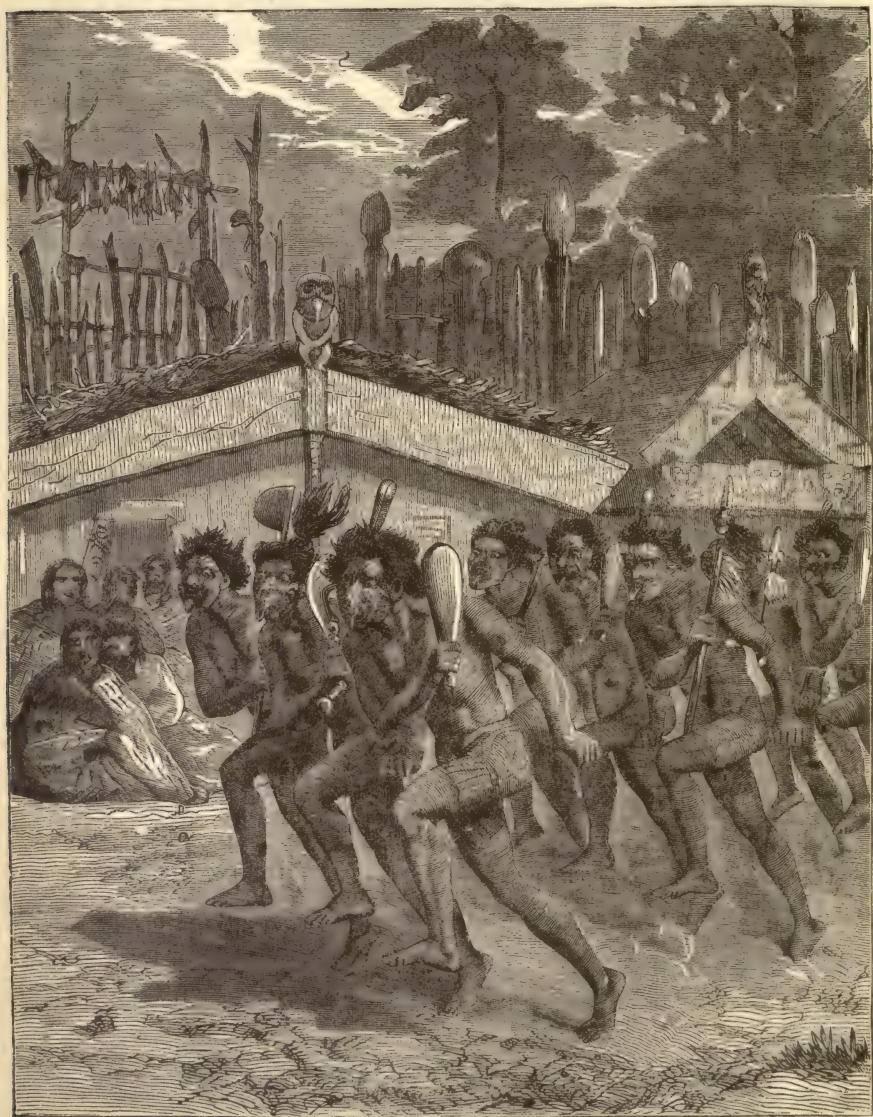
"But," inquired Mr. Bennet, "why is all this uproar? Why cannot we still rub noses, and buy and sell, and barter, as before?" At this moment a stout slave, belonging to the chief, stepped up behind Mr. Bennet, and pinioned both his arms close to his sides. No effort was made to resist or elude the gigantic grasp, the white man knowing that such would accelerate the threatened destruction. Still, therefore, he maintained his calmness, and asked the chief the price of a neck ornament which the latter wore. Immediately another slave raised a large tree-felling axe (which, with others, had been brought to be sharpened by the ship's company) over the head of the prisoner. This ruffian looked with demon-like eagerness and impatience toward his master for the signal to strike.

Frightful Savage Ferocity.

And here it may be observed that our good countrymen can have no idea of the almost preternatural fury which savages can throw into their distorted countenances, and infuse into their deafening and appalling voices, when they are possessed by the legion-fiend of rage, cupidity and revenge. Mr. Bennet persevered in keeping up conversation with the chief, saying, "We want to buy hogs, potatoes, fish, of you." Just then he perceived a youth stepping on deck with a large fish in his hand. "What shall I give you for that fish?"—"Why, so many fish-hooks."—"Well, then, put your hand into my pocket and take them." The fellow did so. "Now put the fish down there, on the binnacle, and bring some more, if you have any," said Mr. Bennet. At once the fish that he had just bought was brought round from behind and presented to him again for sale. He took no notice of the knavery, but demanded, "What shall I give you for that fish?"—"So many hooks."—"Take them. Have you no other fish to sell?" A third time the same fish was offered, and the same price in hooks required and given, or rather taken, by the vendor, out of his jacket pockets, which happened to be well stored with this currency for traffic. A fourth time Mr. Bennet asked, "Have you not another fish?" At this the rogues could contain their scorn no longer, but burst into laughter, and cried, "We are cheating the foreigner!" supposing that

their customer was not aware how often they had caught him with the same bait. The natives were pleased with their own shrewdness.

By this ingenious plan of pretending to be the dupe of the Maories,



THE GROTESQUE MAORI WAR DANCE.

Mr. Bennet contrived to gain time, of which he knew that every minute was of the greatest importance, and at last he was rewarded for his

courageous diplomacy by the arrival of a boat, in which was a friendly chief, who at once cleared the ship.

Hideous War Dances.

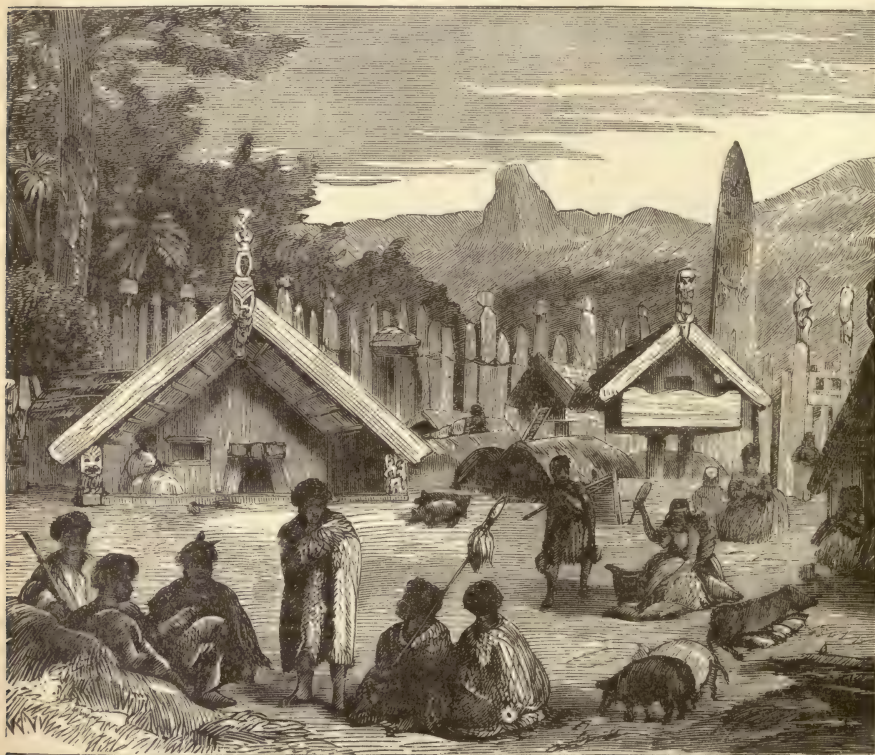
Before a party engage in war, they think themselves bound to join in a war dance. There are war dances in almost all savage tribes, but that of the New Zealander surpasses them all. In other cases, each warrior gives himself up to the excitement of the moment, and shouts, yells, dances, and brandishes his weapons as he seems to think fit; but the Maori warrior's dance is of a far different character, being guided by a discipline and precision of drill to which that of the Russians themselves is loose and irregular. They begin by smearing the whole of their clothing and by painting their faces with scarlet ochre, so as to make themselves as hideous as possible. When they assemble for the dance, they arrange themselves in lines, mostly three deep, and excite their naturally passionate disposition to the highest pitch by contorting their faces and thrusting out their tongues as an act of defiance, interspersing these gestures with shouts, yells, and challenges to the enemy. The dance itself begins with stamping the feet in perfect time with each other, the vigor of the stamp increasing continually, and the excitement increasing in similar proportion.

Suddenly, with a yell, the whole body of men leap sideways into the air, as if actuated by one spirit, and, as they touch the ground, come down on it with a mighty stamp that makes the earth tremble. The war song is raised, and in accordance with its rhythm the men leap from side to side, each time coming down with a thud as of some huge engine. The effect of the dance upon the performers is extraordinary. It seems to make them for the time absolute maniacs, their whole nature being given up to the furious excitement of the moment. Their faces are frightfully contorted, and thus assume an absolutely demoniacal expression. Even when war is not impending, the magic influence of the dance affects the performers as strongly as if they were close to a pah or fort of the enemy, ready for battle; and when, as is sometimes the case, the Maories give a dance in honor of a visitor, they become so furiously excited that they are quite dangerous until they have had time to cool.

Strange Antics of a Chief.

On one such occasion a party of Maories who had visited a ship were requested to exhibit their war dance, and very good naturedly did so. But in a short time their measured leaps became so vehement, and their stamps so powerful, as they shouted the martial rhymes of the war song, that they shook the whole ship as if by blows of a battering-ram; and

the commanding officer, fearful that they would absolutely smash the deck, begged them to desist. His entreaties were in vain, even if they were heard, though it is very likely that, in their furious excitement, the dancers were deaf to every sound except the war song which they were yelling at the top of their voices; and the dance proceeded to its end, and did not cease until the performers were quite exhausted by the furious exertions they had made, desisting only when compelled to do so.



INTERIOR OF A PAH OR NATIVE VILLAGE.

The most ludicrous part of the dance was the conduct of the chief. He had been treated with much attention, and presented with a full suit of naval uniform, of which he was mightily proud, and in which he stalked the deck to the great admiration of his subjects. When he was asked whether the war dance could be given, he at once ordered his followers to accede to the request, and at first stood quietly by while they went through the performance. The influence of the dance was, however, too contagious to be resisted, and rapidly extended itself to him.

First he merely swayed his body in rhythm with the steps of the dancers, then he joined *sotto voce* in the song, then he began to stamp in time with them, and at last threw off all restraint, sprang into line, and leaped, yelled, and stamped as enthusiastically as any of them, splitting his new garments to pieces, and presenting a very sorry sight when his excitement died away.

The annexed illustration represents a portion of a party of warriors as they appear when performing their war dance. Only the first three ranks of them are seen; but the reader must picture for himself the long line of warriors stretching into the distance, numbering often from one to two hundred. The leading chief is seen in front, with his green jade *merai* in his hand; and another but inferior chief is stationed behind him. In the background is shown a portion of the *pah* or village in which the dance is taking place; a chief's storehouse for food is seen on the right, and under the shelter of the houses are seated the women who are watching the dance.

Mimic Warfare Among Children.

We have already said that war is always in the thoughts of a genuine Maori. Unlike the vaporing Fiji warrior, who is always ready to boast, and seldom ready to fight, preferring to knock his enemy on the head when asleep, the Maori is a brave soldier, accustomed from his earliest childhood to deeds of war. A mimic war forms one of the favorite games of the Maori children, though it is necessarily restricted to boys. Just as boys of our country build snow castles, and attack and defend them with snow-balls, so do the young New Zealanders build miniature forts, and enact on a small scale the deeds of actual war, using light sticks instead of the *merai* and *patu*. They make their forts by erecting mounds of earth, and building the fortresses of stakes, in exact imitation of the more substantial architecture of the veritable *pah*.

These ingenious villages well exemplify the whole system of Maori warfare. The two opposing parties seldom meet each other in the open ground, as is the case with civilized warfare; neither do they employ an irregular skirmishing fight among trees or under cover, as is the case with many savage tribes. The attacking party is sure to be very superior in numbers to their foes, and the latter, knowing that this will be the case, resort to the system of fortification, and entrench themselves in forts or villages. These villages are marvelous examples of uncivilized engineering, and are admirably adapted to the purpose which they are intended to fulfil. They are always placed in some strong situation, sometimes on the seashore, sometimes on heights, and one or two of the

strongest are built on the very edge of a perpendicular precipice, so that they cannot be attacked on three sides, while the fourth can only be approached by a narrow and awkward path, along which only a few men can pass, and which can be defended by a comparatively limited number of the besieged.

They are fenced round with very strong posts, lashed together so firmly that they are able to resist any ordinary attack. Since firearms were introduced, the Maories have modified the structure of the pahs to suit their new weapons, throwing out angles to secure a flanking fire, and filling the interior with trenches in which the defenders can lie secure from the fire of the enemy. Since experiencing the terrible power of shells, the natives have learned to construct cross-walls in the trenches, which not only guard the inmates from the fragments of the shells, but prevent an enfilading fire from doing much damage. Rifle-pits are also constructed with singular ingenuity. One pah was remarkable for being built over a number of boiling springs, which were used as traps for the enemy when the fort was besieged.

Caught in a Trap.

The reader may remember the unfortunate business at the Gate Pah, at Tauranga. When taken by storm, the pah appeared to be empty and deserted, the natives having apparently escaped, according to their custom, when they found the place no longer tenable. They had, however, laid a trap, into which the assailants fell. When the latter had scattered themselves over the interior, and were quite off their guard, picking up arms, utensils, and other objects lying carelessly about, a terrific musketry fire was opened from under their very feet, the natives having constructed pits in which they hid themselves until the enemy were attracted within their range by the weapons and implements which they had laid on purpose to act as a bait. The men, who were entirely off their guard, and many of whom besides were but raw recruits, were struck with a sudden panic, and, with a few honorable exceptions, rushed out of the pah, followed and cut up by the fire of the wily foe.

Of course the repulse was but temporary; but such a stratagem as this is sufficient to show the military genius of the Maori, who, if he becomes an enemy, is one that cannot be despised with impunity. This system of taking the enemy by surprise is the usual mode of fighting among the Maories, who display wonderful ingenuity in contriving ambushes, and enticing the enemy into them. If the assailants succeed in taking the pah, a terrible massacre always ensues. Every man is killed who is capable of wielding a weapon, while the women and children are

carried off to become the slaves of the conquerors—a doom from which there is no escape; the unfortunate women, their children, and any future offspring, being slaves without the possibility of release, not even their own tribe being able, according to Maori law, to interfere with the right of the captors, and take from them their lawful captives.

The bodies of the warriors are of course reserved to be baked and



A CHIEF PREPARED FOR BATTLE.

eaten. Sometimes even the prisoners fall victims to the thirst for blood which characterizes these islanders; and in this respect the women are as bad as the men, if not worse. For example, the principal wife of a very great chief, named E'Hongi, was accustomed, even though blind, to murder some of the captives, when they were brought home by her for-

midable husband. Her own end, was, however, more tragic than that of any of her victims. E'Hongi was in the habit of making long excursions to different parts of the country, in which he took his wife with him. On one of these excursions she fell sick, and had to be left behind. In consequence of her blindness, added to her debility, she was unable to act in her own defence, and a number of dogs, discovering her weakness, tore her to pieces and devoured her.

She seems, however, to have been a woman of unexceptionally strong feelings of vengeance. She had a little slave-girl to attend upon her, toward whom she evinced a strong attachment. The little creature was interesting and good-tempered, and her mistress was apparently so fond of her that she was spared the experience of the misery of slavery; she was only a favorite.

Tragic End of the Blind Queen.

E'Hongi returned from one of his successful expeditions of war, but had left a son upon the field of battle, and the lamentation was great. The petted slave-child laid her head upon the lap of her mistress, and poured out her share of the general sorrow. But the spirit of vengeance or of insane retribution came over the heart of the bereaved mother; and she carried the child to the water, and cruelly suffocated her in satisfaction of her selfish sorrow. It was not long after this incident that she met with her death. When she was left behind, a small shed was erected on poles, according to native custom, and a supply of food was placed near her. When the party returned the shed was lying prostrate, and among its ruins were the whitened bones of the inmate. It is supposed that the wind blew down the shed, and so enabled the dogs to reach her.

This same E'Hongi was a really remarkable man, and earned a great name for wisdom and courage. Having made a voyage to England, he threw all his energies into strengthening his military power, and took back with him a quantity of muskets and ammunition. He came back to his own country exactly at the proper time. A long and somewhat desultory war had been going on between the Waikatos and other tribes, in which the former had, after many vicissitudes, been victorious, and, after finally conquering their enemies, had returned to their country in triumph.

Just then E'Hongi came back to his own tribe, distributed his firearms among the best warriors, and when he had instructed them in the use of the new and terrible weapons, entered the Waikato country, and attacked their great village. The Waikatos, having only their clubs, and not having sunk the trenches which in these days are dug in every pah that

is intended to resist an assault, could not contend against firearms, and in a few minutes the fort was taken.

The slaughter on this occasion was terrible, two thousand warriors being killed, and their bodies eaten by the victorious tribe, who built vast numbers of ovens for the special purpose of cooking the bodies of the slain. For many years afterward the remains of the ovens, and the whitened bones of the two thousand warriors, might be seen as tokens of the terrible scene, where feasts were kept up until all the bodies had been consumed, and every evil passion of unrestrained human nature was allowed to have its full sway.

Prisoners without number were captured on this occasion; and indeed the supply of slaves thus obtained so far exceeded the demand for them, that the tribe killed many of them on their journey home, merely to rid themselves of them. E'Hongi, though known to be a man of the most determined courage, not to say ferocity, when engaged in war, and rather disposed to behave in an overbearing manner toward those whom he considered as his inferiors, was at the same time peculiarly mild and courteous in his demeanor to his equals, and toward strangers was remarkable for his gentle treatment.

The religion of the Maories is a curious mixture of simplicity and elaboration, having the usual superstitions common to all savage tribes, and being complicated with the remarkable system of "tapu," or "taboo" as the word is sometimes spelt. Of real religion they have no idea, and, so far as is known, even their superstitions lack that infusion of sublimity which distinguishes the religious systems of many savage nations. They have a sort of indefinite belief in a good and evil influence; the former going by the name of Atua, and the latter of Wairua. Now, Atua is a word that has a peculiar significance of its own. It may signify the Divine Essence, or it may be applied to any object which is considered as a visible representative of that essence.

A Singular Incident.

Thus, if a Maori wishes to speak of God, he would use the word Atua. But he would equally apply it to a lizard, a bird, a sun-ray or a cloud. There is one species of lizard, of a lovely green color, which is held in the greatest veneration as a living representative of divinity, and is in consequence always dreaded as an Atua. The following incident, narrated by a traveller, will show how deeply the belief in witchcraft and the supposed influence of the Atuas obtains among those who are still heathen. A missionary was shown some small green lizards preserved in a vial of spirits, Muriwenua and another man being in the room: We forgot at the

moment that the little creatures in the vial were atua, or gods, according to the superstitious belief of Maori polytheism, and inadvertently showed them to the man at the table. No sooner did he perceive the atua than his Herculean frame shrank back as from a mortal wound, and his face displayed signs of extreme horror. The old chief, on discovering the cause, cried out, "I shall die! I shall die!" and crawled away on his hands and knees; while the other man stood as a defence between the chief and the atua, changing his position so as to form a kind of shield, till Muriwenua was out of the influence of their supposed power. It was a dangerous mistake to exhibit these atua, for the chief is very old, and in the course of nature, cannot live long, and, if he dies shortly, his death will certainly be ascribed to the baneful sight of the lizard gods, and I shall be accused of witchcraft. In connection with this superstition about the lizard, the same traveller mentions a strange notion which prevails regarding a spider.

Curious Belief in Witchcraft.

On the beach of the west coast is found a small, black, and very venomous spider. Its bite is exceedingly painful, and even dangerous, and the natives think that if he bites a man and escapes, the man will die. But if he contrives to catch the spider, and makes a circle of fire around it so that it perishes in the flames, then the man recovers as the spider dies.

The extent to which the imagination of the natives is excited by their fear of witchcraft is scarcely credible. There was one woman who was a very celebrated witch, and exercised extraordinary influence over the minds of the people, who looked upon her as a superior being. On one occasion, when angry with a man, she told him she had taken out his heart. The man entirely believed her, and died from sheer terror.

It is a rather curious fact that, contrary to the usual custom, these heathen priests did not oppose the Christian missionaries, but were among the first to receive the new religion. Some of them seem to have received it too hastily and without sufficient knowledge of its principles, as we see from the miserable travesty of Christianity which has sprung up of late years among the Maories, and which is in New Zealand what the system of Taeping is in China. The priests are, as a rule, the most expert artists and woodcarvers in the country; so that the word priest is often applied by the natives to a man who is skillful in any art, no matter whether he be a priest or not. The annexed illustration is a portrait of a very celebrated priest. His name was Te Ohu. The portrait was obtained during a great meeting of chiefs at the capital. Te Ohu distinguished himself greatly on this occasion, running about after the fashion of Maori orators, shaking his long and grizzled locks from side to side, stamping fur-

ously on the ground, and uttering his speech in a singularly deep and sonorous voice.

In the background of the sketch may be seen two remarkable articles. The one, which is the half of a canoe, stuck upright in the ground, marks the grave of a deceased chief; and the other is a pole, on which are hung a calabash of water and a basket of food, with which the spirit of the dead can refresh himself when he returns to visit the scene of his lifetime. Sometimes a dish of cooked pigeons is added; and in one case a model of a canoe, with its sail and paddles, was placed on the tomb, as a conveyance for the soul of the departed when he wished to cross the waters which lead to the eternal abodes of the spirit.

Evil spirits are supposed to haunt certain spots, which are in consequence, avoided by the New Zealander. Mountains are especial objects of his veneration, and those which are lofty enough to have their tops covered with perpetual snow are specially feared. He fancies that they are inhabited by strange and monstrous animals, that fierce birds of huge size sit continually on their whitened tops, and that every breeze which blows from them is the voice of the spirit which haunts it. In consequence of these superstitions, the natives can no more be induced to ascend one of these mountains than to approach a burial ground. There is a strange le-



TE OHU, A NATIVE PRIEST.

gend of a spot near Mount Egmont. Owing to the nature of the ground, a strong chemical action is constantly taking place, which gives out great quantities of sulphuretted hydrogen gas. The natives say that in former days an atua was drowned near the spot, and that ever since that time his body has been decomposing, thus accounting for the strange phenomenon.



A TIKI AT THE VILLAGE OF ROERA.

together with several others, near the tomb of the daughter of an old chief, and, like the monument which it seems as it were to guard, is one of the finest examples of native carving to be found in New Zealand. The precise object of the tiki is uncertain; but the protruding tongue of the upper figure seems to show that it is one of the numerous

There are many representations of the human form, which are popularly believed to be idols. It was formerly supposed that the green jade ornaments which are worn suspended from the neck, were idols; but it is now known that they are merely ornaments, deriving their sole value from being handed down from one generation to another. Three examples of the so-called idols are here given. One of them is remarkable for its gigantic proportions and curious shape. It is about sixteen feet in height, and instead of consisting of a single human figure, as is usually the case, the enormous block of wood is carved into the semblance of two figures, one above the other. This arrangement is not uncommon in New Zealand, and is found also in Western Africa.

This gigantic tiki stands,

defiant statues which abound in the islands. The natives say that the lower figure represents Maui, the Atua who, according to Maori tradition, fished up the islands from the bottom of the sea. As may be seen in the illustration, nearly the whole of both figures is carved with most elaborate curved patterns, which descend over the arms, and adorn those parts of the statue which do duty for hips. A portion of the village is seen in the background, and around the tiki grow many plants of the phormium, or New Zealand flax. Near this wonderful and mysterious piece of carving stand several others, all of an extraordinary type. Two such tikis are shown in the illustration, drawn from sketches taken at Whakapokoko. Although not quite so large as the double tiki of Roera, they are of very great size, as may be seen by contrasting them with the figure of the woman who is standing by one of them.



GROTESQUE WOODEN IDOLS.

The firmest belief in witchcraft prevails in New Zealand, though not to such an extent as in many parts of Africa. In cases of illness for which no ordinary cause can be discovered, especially if the person be of high rank, witchcraft is always suspected. If a chief, for example, fancies that he has been bewitched, he thinks over the names of those who are likely to have a spite against him, and pitches upon some un-

fortunate individual, who is thereby doomed to death. One curious example of such a murder is related by a missionary. He met a party of natives, who told him that a woman, a relation of the chief Nawaka, had been shot by another chief, who suspected that she had bewitched his son. The young man had been taken ill, and, though the woman in question did her best to cure him, he died. His father took it into his head that she had killed him by her incantations, and, after loading his musket with stick, shot her through the body. As, however, she was the relation of Nawaka, it was expected that the chief would demand compensation for her death, and that the murderer would have to pay a very heavy sum.

There are several modes of witchcraft; but that which is most practised is performed by digging a hole in the ground and invoking the spirit of the person who is to be bewitched. After the incantations are said, the invoked spirit appears above the hole like a flickering light, and is then solemnly cursed by the witch. Sometimes, instead of digging a hole, the witch goes by night to a river bank, and there invokes the spirit, who appears as a flame of fire on the opposite bank. A curious account is given of a district which is supposed to be the special abode of witches. It is situated in the northern island, and consists of steep and barren hills. The inhabitants of this district are few and scattered, and have the reputation of being the greatest witches in the country.

They are much feared, and have little connection with the neighboring tribes, who avoid them, if possible. If they come to the coast, the natives there scarcely venture to refuse them anything, for fear of incurring their displeasure. Like our witches and sorcerers of old, they appear to be a very harmless people, and but little mixed up with the quarrels of their neighbors. It is a curious fact that many of the old settlers in the country have become complete converts to the belief in these supernatural powers. Witchcraft has been the cause of many murders, in consequence of people declaring on their death-beds that they had been bewitched.

Strange Scenes in the Sandwich Islands.

Few people among the wild races of men are more interesting to the traveller than the natives of the Sandwich Islands. The men are tall, active and powerful, and in color are of an olive brown, the precise depth of tint varying much according to the exposure to the sun, so that the skins of the chiefs are much lighter than those of the common people. The hair is jet black, and not in the least woolly, being sometimes quite straight, and sometimes wavy. The face is mostly wide, and is a very handsome one, the only fault in it being a tendency to width across the

nostrils. The men all wear the *maro* or *malo*, which is a slight girdle of cloth, and having this, they consider themselves dressed for all purposes of decency. They also have a *tappa*, or bark-cloth garment, which is twisted round the waist, and falls below the knees, while the better class wear also a sort of mantle, to shelter their skin from the darkening sunbeams.

The great chiefs have also mantles made of a sort of network, into each mesh of which are interwoven the feathers of various birds, the most precious of them being that which supplies the yellow feathers. This is one of the honey-birds, and under each wing there is a single yellow feather, one inch in length. King Kamehameha, had a cloak made of these feathers alone. It was four feet long, and eleven feet at the bottom. No less than nine successive kings died before this priceless mantle was finished. The head-dress of the chiefs is of so graceful and classical a form as absolutely to startle the spectator. It is a helmet made of wicker-work and covered with feathers, the shape being exactly that of the ancient Grecian helmet even to the elevated crest which runs over the top. It is not intended as a protection for the head, the material being too fragile for such a purpose, but is simply a badge of rank and wealth. Mostly they are covered with scarlet and yellow feathers, disposed in broad bands or belts, and the wealth of the wearer may be known by the proportion which the yellow and scarlet feathers bear to each other.

A Remarkable Female Beauty.

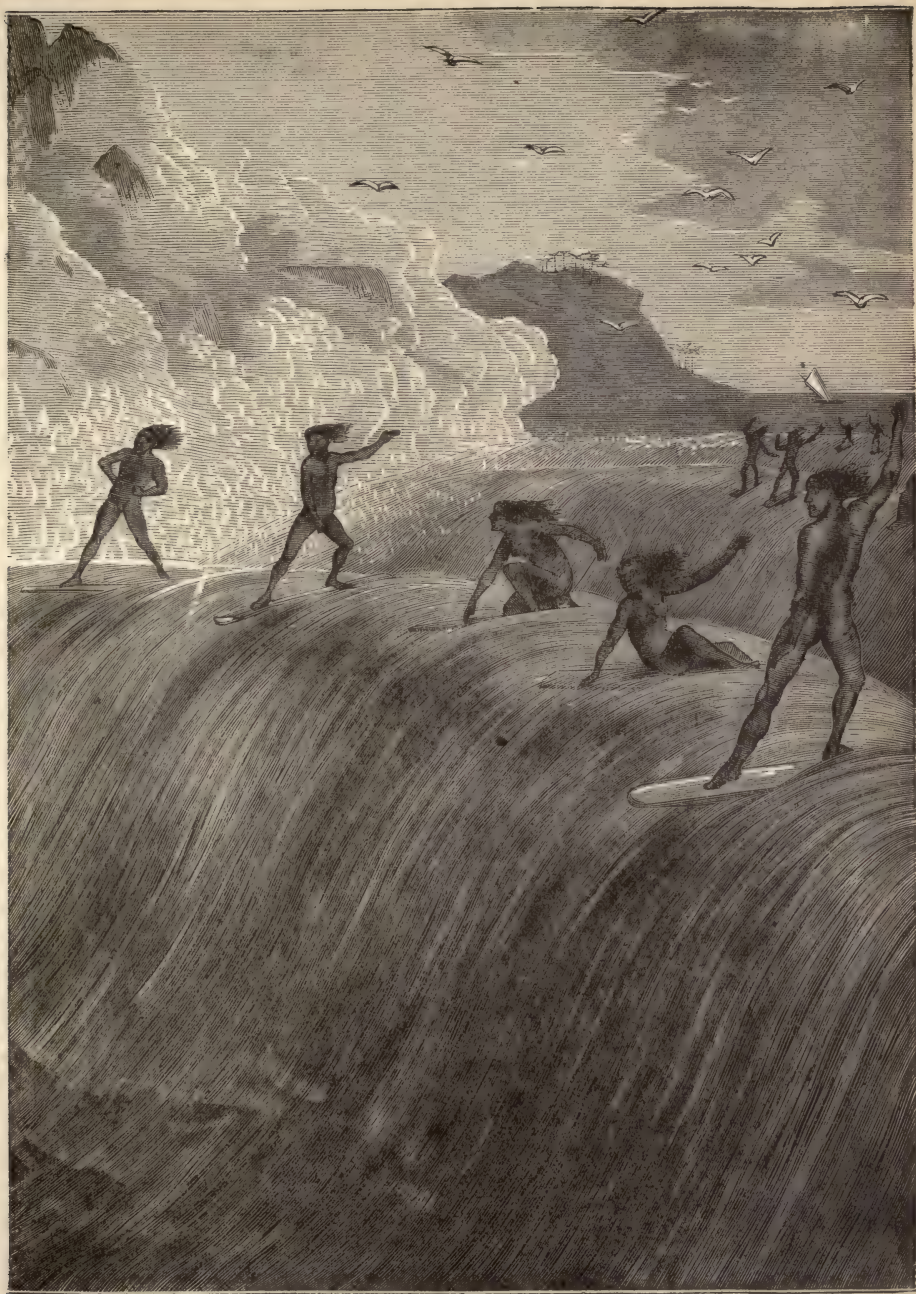
The women, when young, are singularly beautiful, and retain their good looks longer than is usual among Polynesians. Like the other sex, however, they generally attain to great size in their latter years, those of the better sort being remarkable for their enormous corpulence. This development is probably owing, like that of the Kaffir chiefs, to the great quantity of porridge which they are continually eating. When young, however, they are exceedingly beautiful, their features having a peculiar charm of their own, and their forms being like those of the ancient Grecian statues. An American traveller gives a most animated description of a native girl, in his interesting work on the Sandwich Islands, showing that the partial civilization to which the natives have been subjected has not destroyed their beauty of features nor symmetry of form. In truth to nature, it may be safely asserted that beauty is not confined merely to the saloon of the monarch, nor to the tapestried chambers of the patricians. It is more frequently found amid the lowlier walks of life, on the desert, or the distant isle of the ocean.

In this instance I wish to be understood as speaking of physical beauty only. On leaving the shore-road to ascend the mountains for Halawa, I met just such a specimen as has often driven men mad, and whose possession has many a time paved the way to the subversion of empire on the part of monarchs. She was rather above the medium size of American women. Her finely chiselled chin, nose, and forehead were singularly Grecian. Her beautifully moulded neck and shoulders looked as though they might have been borrowed from Juno. The development of her entire form was as perfect as nature could make it. She was arrayed in a single loose robe, beneath which a pretty little nude foot was just peeping out. Her hair and eyebrows were as glossy as a raven's wing. Around her head was carelessly twined a wreath of the beautiful native flowers. Her lips seemed fragrant with the odor of countless and untiring kisses.

But her eyes! I never shall forget those eyes! They retained something that spoke of an affection so deep, a spiritual existence so intense, a dreamy enchantment so inexpressively beautiful, that they reminded one of the beautiful Greek girl Myrrha, in Byron's tragedy of "Sardanapalus," whose love clung to the old monarch when the flame of the funeral pile formed their winding sheet. In no former period of my life had I ever raised my hat in the presence of beauty, but at this moment, and in such a presence, I took it off. I was entirely fascinated, charmed, spell-bound now. I stopped my horse; and there I sat, to take a further glance at the fair reality. And the girl stopped, and returned the glance, while a smile parted her lips and partly revealed a set of teeth as white as snow, and of matchless perfection. I felt that smile to be an unsafe atmosphere for the nerves of a bachelor; so I bowed, replaced my hat and passed on my way, feeling fully assured that nothing but the chisel of Praxiteles could have copied her exquisite charms. And as I gently moved past her she exclaimed in the vocabulary of her country, "Love to you."

Extraordinary Agility in the Waters.

The semi-amphibious nature of the Sandwich Islanders is well known. Both sexes turn their aquatic powers into a means of amusement. There is a salt-water lake called Loki Nomilu, which was said by the natives to be the handiwork of the terrible fire-goddess, Pele, who dug deep into the ground in search of fresh water, but was baffled by the sea finding a subterranean entrance, although the lake is many yards from the shore. Being angry with the sea for its misconduct she took her departure, and took up her abode in the crater of the great volcano of Hawaii, which is called by her name. There is little doubt that the lake in question is the crater



MARVELOUS SURF-SWIMMING OF SANDWICH ISLANDERS.

of an extinct volcano. A traveller went to visit this extraordinary lake and gives the following account of the mode by which its actual depth was ascertained: Having been informed that this lake was fathomless, I felt only more solicitous to test the mystery. There were no means, however, on the premises; and, two women excepted, the little village was temporarily deserted. There were several canoes on the shore, but the lake was much disturbed by a heavy north wind, so that they would have been rendered nearly useless. But I felt as though I could not abandon the expedition. The gentleman who accompanied me thither informed the women of my object in coming, and assured them that I was extremely anxious to know the depth of the water in that lake, and that we would wait until some of the men returned from their fishing excursion. But one of them soon provided a remedy. She proposed swimming into the lake with a sounding line to make the required measurement. Our remonstrance against such a measure was in vain, for she resolutely assured us it would be not only an easy performance, but afford her much satisfaction to have an opportunity of serving me. She procured a piece of wili-wili wood, exceedingly light, about six feet long, and as many inches in diameter. This she insisted on carrying to the north end of the lake.

Novel Feat of a Female Swimmer.

After wading in until she could swim, she placed the log firmly under her chest, keeping it there with one hand and retaining the sounding line with the other. In this position she struck down the lake, stopping at intervals to let down the line, which she knotted at the surface of the water every time she found the bottom. This done, she would gather up her line, replace her log and resume her course. And she pursued this plan until her task was done. It would be superfluous to say that this feat excited our admiration, or that we compensated her for her pains. It was the most novel exhibition I had ever seen; nor could I fully realize it until I remembered that in these islands as in other parts of Polynesia, and the Caribbean Sea, the women and girls are the best swimmers. The Hawaiians are almost amphibious. Volumes might be written detailing their extraordinary feats in the water. It is owing to their frequent bathing that many of the women of Polynesia display such an exquisite physique.

A favorite amusement of the Hawaiians is swimming out to sea on boards made from the bread-fruit tree. It is quite a national sport and very exciting in rough weather. Having swum out to some distance with these boards under their arms, they ride over the breakers on them towards the shore, generally lying face downwards, but the most expert bathers kneel, or even stand up on their boards, mounting each roller at the

right moment, so as to keep exactly on its curl. They are also wonderful divers.

Some of the weapons used by the Sandwich Islanders are rather curious. In the first place they have the spear, which is made of a chestnut colored wood, which takes a high polish, and is usually barbed at the point and brought to a flattened point at the butt. They are exceedingly skilful in the use of this weapon, not only in throwing it, but in warding off the weapons that are flung at them. Kamehameha, the well known king or chief, was celebrated for his skill with the spear. He used to stand with a spear in his right hand in front of six men, also armed with spears. At a given signal they flung their spears simultaneously at him, when he would strike three aside with the spear in his right hand, and catch the other three in his left hand. Our illustration shows the king performing this dangerous and remarkable feat. These spears, which are intended to be thrown, are from six to eight feet in length, and are made to fly straight by being tapered gradually from the head to the butt. There is another kind of spear, which is used as a pike. This is from twelve to fifteen feet in length, and is not barbed.

The sling is another of the Sandwich weapons. It is of considerable length, and the receptacle for the stone is made of plaited matting. The stones are oval in shape, and are ground down for the express purpose, so that the slingers evidently possess much accuracy of aim. There is a modification of the sling, the use of which seems to be forgotten at the present day, and even in Captain Cook's time was far from universal. The stone is cut of an oval shape, with a groove round it, much like a lady's tatting-needle, and the cord is passed round the groove with a half-hitch, so that when the end of the sling is liberated, the stone flies off. Some of these stones obtained by Captain Cook were made of hæmatite, or blood-stone, and were very heavy, weighing at least a pound. It was rather curious that, although there was little difficulty in purchasing the stones, which must have cost much trouble in making, it was not possible to persuade the natives to part with the cord by which they were flung.

A Barbarous Dagger.

Another of their weapons is the dagger. The material of which it is made is a very hard wood, something like ebony, and it is shaped much like the ordinary steel dagger, except that it has no guard. It is about two feet in length, and is secured to the wrist by a cord passing through a hole at the end of the handle. Some of these daggers are still larger, and double-pointed, being held in the middle like the antelope-horn daggers of India. The weapon has a mournful interest from the fact that

when Captain Cook was murdered his body was pierced with innumerable wounds mostly made by wooden daggers, though one of the natives had a dagger made of iron, which they snatched from each other's hands in their eagerness to inflict fresh wounds.

Like most of the Polynesian Islands, the Marquesas are surrounded with coral reefs. The inhabitants are splendid specimens of humanity, the men being remarkable for their gigantic size, great strength, and fine



KING KAMEHAMEHA AND THE SPEARS.

shape, which emulates those of the ancient Greek statues. One of the chiefs was measured carefully, and was found to be six feet eight inches in height, and said that he knew another chief who was at least a foot taller than himself. In general they wear but little raiment, a slight piece of bark cloth round the waist being the only garment which they think needful, the place of clothing being supplied by the tattoo. There are many nations where this decoration is worn; but there are no people on

the face of the earth who carry it out so fully as do the Marquesans, every part of their bodies, even to the crown of the head and the fingers and toes, being covered with the pattern. This extreme elaboration is only to be found in the men, the women contenting themselves with a bracelet or two tattooed on their arms, and a few similar ornaments here and there, thus affording a marked contrast to the other sex.

Sometimes a rich islander will, either from generosity, ostentation, or love to his wife, make a feast in honor of her when she has a bracelet tattooed round her arm, or perhaps her ear ornamented. A hog is then killed, and the friends of both sexes are invited to partake of it, the occasion of the feast being made known to them. It is expected that the same courtesy will be returned in case of the wife of any of the guests being punctured. This is one of the few occasions on which women are allowed to eat hog's flesh.



A TATTOOED CHIEF OF THE MARQUESAS ISLANDS.

The figures with which the body is tattooed are chosen with great care, and appropriate ornaments are selected for the different parts. They consist partly of animals, partly of other objects which have some reference to the manners and customs of the islands; and every figure has here, as in the Friendly Islands, its particular name. Upon an accurate examination, curved lines, diamonds, and other designs are often disting-

uishable between rows of punctures, which resemble very much Grecian ornaments. The most perfect symmetry is observed over the whole body. The head of a man is tattooed in every part; the breast is commonly ornamented with a figure resembling a shield; on the arms and thighs are strips sometimes broader, sometimes narrower, in such directions that these people might be very well presumed to have studied anatomy, and to be acquainted with the course and dimensions of the muscles. Upon the back is a large cross, which begins at the neck and ends with the last vertebra. In the front of the thigh are often figures which seem intended to represent the human face. On each side of the calf of the leg is an oval figure, which produces a very good effect. The whole, in fact, displays much taste and discrimination. Some of the tenderest parts of the body—the eyelids, for example—are the only parts not tattooed. Each finger has its own pattern, so that the hand looks as if enclosed in a very tight-fitting glove.

A Singular Business.


The mode of tattooing is almost exactly like that of the Samoan islanders, except that the puncturing needle is made of the wing-bone of the tropic bird. The operation is always conducted in certain houses belonging to the professional tattooers, who lay on these buildings a tapu, which renders them unapproachable by women. As is the case in Samoa, the best tattooers are men of great importance, and paid highly for their services, a Marquesan thinking that he is bound to be liberal toward a man to whom he is indebted for the charms which he values so highly. These men gain their skill by practising on the lower orders, who are too poor to pay for being tattooed, and who would rather wear a bad tattoo than none at all. A considerable amount is generally exacted at each operation, which lasts from three to six months; and so elaborate is the process, that a really complete tattoo can hardly be finished until the man is thirty years old.

By the time that the last piece of tattoo is executed, the first generally begins to fade, and if the man is rich enough he has the pattern renewed. Some men have been tattooed three times, and, as the patterns cannot be made to coincide precisely with each other, the result is that the whole skin becomes nearly as dark as that of a negro. In this state it is greatly admired, not because the effect is agreeable to the eye, but because it is an indubitable mark of wealth. The pigment used in tattooing is the well-known candle nut, burned to a fine charcoal and mixed with water.

CHAPTER VI.

WILD TRIBES AND THEIR CURIOUS CUSTOMS.

A Remarkable Uncivilized Nation in South America—Description of the Araucanians—A Curious Method of Shaving—A Hairy Upper Lip Thought to be Highly Improper—Disputes Settled by Pulling Hair—Women who Paint their Faces—Savages who Insist on Etiquette—Horses Superbly Decorated—Singular Saddle and Stirrups—Marriage Customs—An Exciting Elopement—A Furious Combat—Expert Horse-back Riders—Using the Lasso—Dangerous Adventure with a Wild Bull—The Animal in the Toils—Disgusting Cannibalism—Preferring Human Flesh to Pork—Old “Turtle Pond”—Savage Atrocity—A Fijian Legend—The Fijian Islander’s Canoe—An Ingenious Contrivance—Expert Navigation—Natives of Borneo—Dyak Pirates—Small Men of Great Strength—Extraordinary Physical Endurance—American Indians—A Hotly Contested Ball Game—An Old Arab Hunter—Capturing a Hippopotamus—The Old “River King” in his Glory—A struggle Against Odds—Daring of the Natives.

N the southern part of South America is a territory occupied by the Araucanian nation. This title was given to them by the Spaniards, just as was the name of Patagonians to their southern neighbors, and, although it is an incorrect one, it has been accepted for so many years that it cannot be conveniently changed for the more correct designation. The people are rather below the middle height, strong, thick-set, broad-chested, and much inferior in point of form to the North American tribes. The head is narrow, and low in front, broad and high behind, and the back of the head falls in almost a direct line with the nape of the neck, a peculiarity by which an Araucanian may almost invariably be distinguished. The foot is as remarkable as the head. It is very short and broad, and rises straight from the toes to the ankle with scarcely any curve, so as to produce a very high but very clumsy looking instep.

Most of the Araucanian tribes have but little beard, and what they have they eradicate after the usual fashion of savages, plucking out the individual hairs instead of shaving. A traveller who had the opportunity of seeing the operation performed thus describes it: At one house where we stopped I saw an Indian, who at first sight seemed to be a white man, from the fact that his beard was grown as though unshaven for a week. He looked red and blotched, and was continually raising his hand to some part of his face, wearing all the while an expression of patient endurance.

A close scrutiny showed that he was engaged in shaving. These Indians pull out or nip off the beard with small steel tweezers. This instrument was originally a clam shell, but, by intercourse with the whites, they have been able to procure a more elegant article. Every dandy carries his tweezers hanging at his neck, and at leisure moments amuses himself by smoothing his face to the taste of his painted mistress. The arguments they use in defence of their treatment of the beard are precisely those used by shavelings the world over.

They do not content themselves with merely removing the hair from the chin, cheeks, and upper lip, but pull out the eyelashes and eyebrows, substituting instead of the latter a slender curved line of black paint. They say that the presence of the eyelashes hinders them in the pursuit of bee hunting, a sport of which they are very fond, and on which they pride themselves greatly. Some of the younger warriors have allowed a very slight fringe of hair to remain on the upper lip, but the older chiefs think that it is an innovation on the ancient customs, and discountenance it as far as they can. The hair of the head is cut short at the top, but is allowed to grow long at the sides, in order that it may be easily grasped, just as the North American tribes leave one long lock on the crown of the head so as to assist the enemy who slays them in getting off the scalp.

Pulling Hair to Settle Disputes.

When two lads quarrel, they settle the dispute with a fight, which is conducted, not by blows of the fist or with a weapon, but by pulling the hair. "Let us pull hair, if you are not afraid," cries one of the disputants to the other. The challenge is never refused. Off goes the poncho, or upper garment, if they happen to be wearing it, the lower garment is tucked tightly into the belt, the combatants allow each other to take a fair grasp of the long locks, and the struggle begins. Each tries to twist the head of his opponent so as to bring him to the ground, and when he has once fallen, they loosen their grasp, rub the backs of their heads, take a fresh grasp, and repeat the struggle until one of them yields. The combat over, all animosity vanishes, and they are good friends again.

Like that of the men, the hair of the women is divided into two long tails, one of which hangs over each shoulder. The tails are wound round with spiral strings of blue beads, and their ends are connected by a string of twelve or fourteen brass thimbles, which hang side by side, like a peal of bells. Besides these ornaments, the women wear a sort of cap, made entirely of beads, and falling over the back of the head as far

as the shoulders. Its lower edge is decorated with a row of brass thimbles, like that which connects the two queues of the hair. This elaborate head-dress is only worn on great occasions, while ordinarily the queues are wound round the head, the two ends projecting in front like horns, a fillet, usually studded with beads, being employed to keep the hair in its place.

Faces Painted Red and Black.

Paint is worn by both sexes, but chiefly by the women, and is anything but ornamental. It is invariably of two colors, red and black, which are mixed with grease, so that they can be applied and removed at pleasure. The usual plan is to have a broad red belt from the ear, taking in the cheeks, eyelids, and nose, the lower edge of the belt being sometimes edged and scalloped with black. The eyelids and lashes are also edged with black, and a thin line of the same hue takes the place of the eyebrows, which are all removed except a very fine row of hairs in the centre. Some of the women further decorate their faces by spots of black paint, and are exceedingly proud of these ornaments.

Death Threatened for Breach of Etiquette.

Etiquette is so highly valued among the Araucanians that on one occasion an English gentleman nearly lost his life by neglecting a ceremonial. It seems that every chief, no matter how petty may be his domain, expects that every stranger who passes through his territory shall pay him a tribute. The amount of the tribute is of little consequence, so that something is given as an acknowledgement of rank. Being new to the country, the gentleman in question was passing through the territory of a chief, when he was stopped and asked for tribute, a demand which he refused to pay, on the ground that he was only a traveller and not a trader. Thereupon a young man leaped into a cabin, brought out a trumpet made of horn, and blew a blast upon it. The signal was answered in all directions, and from every side there poured in a number of mounted and armed warriors. The traveller was not daunted, in spite of the martial array, cocked his pistols, and awaited the attack, when his guide ran up to him, and begged him to give them something, if it were only a pocket-handkerchief.

The traveller saw at once, from the smallness of the suggested present, that it was a mere question of etiquette, and munificently presented the chief with a jack-knife. Enmity immediately gave way to enthusiastic friendship. The old chief was quite overcome by the splendor of the gift, swore eternal friendship with the traveller, and sent a guard of honor to accompany him for several miles on his way.

Like the American tribes in general, they have become wonderful adepts in the use of the horse, the climate, the natives, and the horse seeming to agree with each other in a way which is really remarkable, considering that the animal is of comparatively late introduction into Araucania. Unlike the Patagonians, they pride themselves on the massive solidity of the accoutrements with which they bedizen their horses; and, although they care little about the individual animals, and are rather hard masters to them, they bedeck the horses in the most lavish manner.

Their saddles are made very much after the fashion employed by the Patagonians, being little more than rude wooden frames. A few skins are laid on the back of the horse, the saddle is placed on them, a saddle cloth of thick leather is thrown over it, and the whole apparatus is complete. The bridle is made, like that of the Patagonians, of twisted hide, or sometimes of a number of strips of horse-skin plaited together, a few threads of silver being mingled with them. The bit is generally the ordinary Spanish bit, with its cruelly powerful arrangement of curb and ring.

The stirrups are generally nothing more than a piece of cane twisted into a triangular form, and hung to the saddle by leathern cords; but the wealthy Araucanians pride themselves in having these articles of solid silver.

Stealing a Bride.

Marriage among the Araucanians is an odd mixture of ceremonies. Theoretically, the bridegroom is supposed to steal his wife against her own will and in opposition to the wishes of her parents; practically, he buys her from her parents, who have long looked upon their daughter as a valuable article, to be sold to the first purchaser who will give a sufficient price. Sometimes the match is one of affection, the two young people understanding each other perfectly well. Music is the usual mode by which an Araucanian expresses his feelings, and the usual instrument is the jews-harp. The lover is never seen without his jews-harp hanging from his neck, tied upon a little block of wood to prevent it from being injured, and decorated with strings of many colored beads. Furnished with this indispensable instrument, the lover seats himself at a little distance from the object of his choice, and produces a series of most dolorous sounds, his glances and gestures denoting the individual for whom they are meant.

After a little while, the lover thinks that he had better proceed to the marriage. Should he be a wealthy man he has no trouble in the matter; but if not, he goes among his friends and asks contributions from them. One gives an ox, another a horse, another a pair of silver spurs, and so on.

It is a point of honor to make these contributions, and equally so to return them at some time or other, even if the intended bridegroom has to wait until in his turn he can sell his eldest girl. Next, the friends of the young man assemble, all mounted on their best horses, and proceed in a body to the house of the girl's father. Five or six of the best speakers dismount and ask permission for the marriage, extolling to the utmost the merits of the bridegroom, and expatiating on the happiness of his daughter on be-



AN ARAUCANIAN MARRIAGE.

ing married to such a man. The father, treating the matter as gravely as if he had not done the same thing himself, makes a speech in his turn.

All this ceremony is intended to give time to the young man to hunt for his intended bride, and, until he has found her, they will go on with their speeches. As soon as the young man discovers the girl, he seizes her and drags her to the door, while on her part she screams and shrieks for protection. At the sound of her voice all the women turn out, armed with sticks, stones, and any other weapons which come to hand, and rush to

her help. The friends of the bridegroom in their turn run to help their friend, and for some time there is a furious combat, none of the men escaping without some sharp bruises, and the girl screaming at the top of her voice.

At last the bridegroom dashes at the girl, seizes her as he can, by the hand, the hair, or the heels, as the case may be, drags her to his horse, leaps on its back, pulls her up after him, and dashes off at full speed, followed by his friends. The relatives of the girl go off in pursuit, but are constantly checked by the friends of the bridegroom, who keep them back until he has dashed into the forest with his bride. They halt at the skirts of the forest, wait until the sounds of the girl's screams and the galloping of the horse have died away, and then disperse.

The young couple are now left alone until they emerge from the wood on the second day after the abduction, when they are supposed to be man and wife. That all the fighting and screaming are a mere farce, is evident from the fact that, if a man should offer himself who is not acceptable to the parents of the girl, and should proceed to carry her off, one of her relatives blows the horn of alarm, as has already been mentioned, and all of the male relations turn out and drive off the intruder. Sometimes, however, he succeeds in gaining the bush before he is caught, and in that case the marriage holds good. Some few days after the marriage, the friends call on the newly-married couple, and bring the contributions which they had promised. The whole party then proceed to the house of the girl's father, and offer him these goods, which are taken as if they were mere offerings, and not the price for which the girl was sold. Being satisfied with the presents, he expresses himself pleased with the matter, and congratulates the young couple and their friends.

Expert Horsemanship.

The Araucanians are admirable riders, though their seat would not please an American riding master. They depend entirely on balance for retaining their seat, and seem rather to hang on the horse's back than to hold by any grip of the knee. Indeed, a stranger to the country always thinks that an Araucanian rider is on the point of being thrown, so loose is his seat, whereas the very idea that he can by any possibility be thrown never enters his mind. He and his horse seem one being, actuated by one mind. A traveller once saw a horse take fright, and leap sideways from the object of terror. He thought that the rider must be flung by the suddenness of the movement; but, to all appearance, the man took fright and shied at the same moment with his horse.

The Araucanians make a free use of the lasso. This terrible weapon

is simple enough in principle, being nothing more than a leather rope, forty feet in length, with a noose at the end. It is made of a number of thongs of raw hide, plaited into a round rope, about three-eighths of an inch in diameter; so that, although it appears very slender, it really possesses enormous strength, and an elephant could scarcely break it. When the lasso is to be used, the thrower takes the ring in his left hand, and the lasso in the right, and separates his arms so as to make a running noose nearly six feet in length. Grasping the ring and the cord with his left hand, he slips his right hand along the rope so as to double it, and there holds it. When he throws it, he whirls it round his head until the noose becomes quite circular, and then hurls it at the object, throwing after it the remainder of the rope, which has hung in coils on his left arm. As it passes through the air, the noose becomes gradually smaller, so that the thrower can always graduate the diameter of the noose to the object which it is intended to secure.

Thrilling Adventures with Wild Animals.

The skill with which they fling this noose is wonderful, as may be seen from the following account of a struggle with an infuriated bull; the capture of a particular animal from a herd, within a range of pasture utterly unbounded except by mountains and rivers, is often difficult, and gives rise to many very exciting and ludicrous scenes. Even when taken, the captives are not easy of management, their attachment for old associates manifesting itself in frequent attempts to return.

One particular bull gave great trouble. He was a noble fellow, of spotless white—such an one as bore the beautiful Europa through the Phœnician deep, or such an one as might be worshipped on the shores of the Ganges. After a long time he was lassoed, and the horseman, who had literally taken the bull by the horns, started off complacently to lead him to the place of gathering. But his bullship did not take the going as a matter of course; for, with a mad bellow, he charged upon his captor, who, seeing a very formidable pair of horns dashing toward him, started at full gallop, still holding fast the lasso, which he in vain tried to keep taut. The horse was jaded, and “old whitey” was fast gaining. Another Indian bounded forward, and, dexterously throwing his lasso, caught the unoccupied horn, bringing up the prisoner with a round turn.

The bull was not yet conquered. After plunging, pawing, bellowing, and tossing for a while, he changed his tactics. Making a rush and a feint at one of his annoyers, he wheeled about suddenly, and nearly succeeded in catching the other on his horns. Things were becoming more complicated than ever, when, as the infuriated animal stood head down,

with his tail stuck out at an angle of fifty-five degrees, a third horseman came to the attack, and whirling his lasso with a jerk, caught the caudal extremity in a running knot.

A Droll Dilemma.

Thus the two men at the sides were safe, provided that the man behind kept his lasso strained. But a question in the rule of three now arose. If three men catch a bull, one by each horn, and one by the tail, and all pull in different directions, which way can the bull go? No one seemed able to work out the answer; but a man named Katrilas was ready for all emergencies, and, dismounting, he started to the assistance of his companions, armed with a long lance and an old poncho. Running before the bull, he threw the poncho on the ground, a few paces in front, the men behind slackened a little, and the bellowing captive made a desperate plunge at the red cloth. A jerk on the tail stopped further progress, till Katrilas, picking up the poncho on the tip of the lance, tossed it several yards in advance. There was another slackening, another jerk, and so on, until the "critter" was brought to the desired spot.

The next trouble was to loose the captive. Sundry scientific pulls brought him to the ground, and Katrilas, springing forward, stripped the lassos from his horns. But another remained on the tail. That no one would venture to untie, for the bull had risen, and stood glaring frantically around. An Indian, unsheathing his long knife, ran full tilt at the extended tail, and with one blow severed the greater part of that useful member from the body. The last was literally the "unkindest cut of all." The poor brute was fairly conquered. He stood with head hanging, eyes glaring, the tongue lolling from his frothy mouth, his once spotless coat defiled with foam and dirt, while the drip, drip, drip, of the warm blood upon his heels rendered the abjectness of his misery complete.

Horrible Cannibalism.

We naturally associate cannibalism with the South Sea Islanders, especially the Fijians. The native Fijians are clever enough at concealing the existence of cannibalism when they find that it shocks the white men. A European cotton-grower, who had tried unsuccessfully to introduce the culture of cotton into Fiji, found, after a tolerably long residence, that four or five human beings were killed and eaten weekly. There was plenty of food in the place, pigs were numerous, and fish, fruit and vegetables abundant. But the people ate human bodies as often as they could get them, not from any superstitious motive, but simply because they preferred human flesh to pork. Many of the people actually take a pride in the number of human bodies which they have eaten. One chief was

looked upon with great respect on account of his feats of cannibalism, and the people gave him a title of honor. They called him the Turtle-pond, comparing his insatiable stomach to the pond in which turtles are kept; and so proud were they of his deeds, that they even gave a name of honor to the bodies brought for his consumption, calling them the "Contents of the Turtle-pond."

A Case of Shocking Atrocity.

One man gained a great name among his people by an act of peculiar atrocity. He told his wife to build an oven, to fetch fire-wood for heating it, and to prepare a bamboo knife. As soon as she had concluded her labors her husband killed her, and baked her in the oven which her own hands had prepared, and afterward ate her. Sometimes a man has been known to take a victim, bind him hand and foot, cut slices from his arms and legs, and eat them before his eyes. Indeed, the Fijians are so inordinately vain, that they will do anything, no matter how horrible, in order to gain a name among their people. Cannibalism is ingrained in the very nature of a Fijian, and extends through all classes of society. It is true that there are some persons who have never eaten flesh, but there is always a reason for it. Every Fijian has his special god, who is supposed to have his residence in some animal. One god, for example, lives in a rat, as we have already seen; another in a shark; and so on. The worshipper of that god never eats the animal in which his divinity resides; and as some gods are supposed to reside in human bodies, their worshippers never eat the flesh of man.

According to the accounts of some of the older chiefs, there was a time when cannibalism did not exist. Many years ago, some strangers from a distant land were blown upon the shores of Fiji, and received hospitably by the islanders, who incorporated them into their own tribes, and made much of them. But, in process of time, these people became too powerful, killed the Fijian chiefs, took their wives and property, and usurped their office. In this emergency the people consulted the priests, who said that the Fijians had brought their misfortunes upon themselves. They had allowed strangers to live, whereas, "Fiji for the Fijians" was the golden rule, and from that time every male stranger was to be killed and eaten, and every woman taken as a wife.

Terrible Sacrifice of Human Life.

As the Fijians set such a value on human flesh, it is to be expected that they will invent a variety of excuses for obtaining it. For example, when a chief builds a house, he kills at least one human victim to celebrate the event. If he builds a large war canoe, a series of sacrifices

takes place. A man is killed, for example, when the keel is laid, and, if the chief be a very powerful one, he will kill a victim as each plank is fixed in its place. Even when it is finished the slaughter is not over, as, in the first place, the planks of the new vessel have to be washed with human blood, and in the next, the launch must be commemorated in the same way as the building. One chief gained some notoriety by binding a number of men, and laying them side by side along the shore to act as



FIJIAN CANOE IN A STIFF BREEZE.

rollers over which the canoe was taken from the land into the sea. The weight of the canoe killed the men, who were afterward baked and eaten.

Speaking of the Fijian canoe, which may be called one of the institutions of the country, the best example is the double canoe, where two boats are placed side by side. The two canoes are covered over, so as to keep out the water, and are connected by a platform which projects over the outer edges of both boats. Hatchways are cut through the platform, so as to

enable the sailors to pass into the interior of the canoes. In the illustration a man is seen emerging from the hatch of the outer canoe. Upon this platform is erected a sort of deck-house for the principal person on board, and on the top of the deck-house is a platform on which stands the captain of the vessel, so that he may give his orders from this elevated position, like the captain of a steamboat from the paddle-box or bridge. This position also enables him to trace the course of the turtle if they should be engaged in the profitable chase of that reptile.

The mode of managing the vessel is extremely ingenious. The short mast works on a pivot at the foot, and can be slacked over to either end of the vessel. When the canoe is about to get under way, the long yard is drawn up to the head of the mast, and the latter inclined, so that the mast, the yard and the deck form a triangle. The halyards are then made fast, and act as stays. When the vessel is wanted to go about, the mast is slacked off to the other end so that the stern becomes the bow, the tack and the sheet change places and away goes the vessel on the other course.

Merry Boatmen Singing Songs.

It will be seen that such a canoe sails equally well in either direction, and, therefore, that it can be steered from either end. The rudder is a very large oar, some twenty feet in length, of which the blade occupies eight, and is sixteen inches wide. The leverage of such an oar is tremendous, and, in a stiff gale, several men are required to work it. In order to relieve them in some degree, rudder-bands are used; but even with this assistance the men have difficulty in keeping the canoe to her course, and are nearly sure to receive some very sharp blows in the side from the handle of the steering oar. Sometimes a sudden gust of wind, or a large wave, will bring round the rudder with such violence that the handle strikes a man in the side and kills him. With all these drawbacks, canoe sailing is a favorite occupation with the Fijians, who are as merry as possible while on board, singing songs to encourage the steersman, watching waves and giving notice of them, and adding to the joyous tumult by beating any drum that they may happen to have on board. Even when the wind fails, and the canoe has to be propelled by poling if she should be in shoal water, or by sculling if she should be too far out at sea for the poles, the crew do their work in gangs, which are relieved at regular intervals, those who are resting singing songs and encouraging those who are at work.

Ferocity of Dyak Pirates.

With the exception of Australia, which may take rank as a continent, Borneo is the largest island in the world. It is situated in the tropics, the equator passing nearly through the centre of it, and forms the centre of the

Indian Archipelago. Until late years, scarcely anything was known of Borneo, but since the late Sir James Brooke accomplished his wonderful series of exploits against the piratical tribes that infested the coast for more than a thousand miles, and destroyed all commerce, the country has been tolerably explored, and the manners and customs of its inhabitants investigated. It is thought that the number of Dyaks (as the natives of Borneo are called) does not exceed forty thousand, many tribes of which have never been near the sea. The sea Dyaks are about three times as numerous as the land Dyaks, and are at the present day much what the old sea-kings were in days gone by. They are essentially a nation of rovers, living by piracy. They are taller than the Land Dyaks, who seldom exceed five feet six inches in height, and much fairer in complexion. The skin of the Land Dyak is brown, whereas that of the Sea Dyak is many shades lighter, and has been compared to the color of a new saddle—a hue which admirably suits the well-developed forms of these people. They are very proud of their complexion, and the women are fond of an excuse for throwing off the jackets which they wear, in order to exhibit their smooth satiny skins, polished and shining as if of new bronze.

Pirates and their Boats.

In order to show at a glance the appearance of various tribes of Borneans, two Dyaks are represented in the engraving. The left hand figure represents an Illinoan pirate. These men are found on the north-western coast of Borneo, not very much above the island of Labuan. The Illinoans possess many large and formidable war boats, which are armed in the bows with a very large gun, and have, after the fashion of Bornean boats, an upper deck, which serves as a platform for the combatants and a shelter for the rowers, who sit beneath. There is a small cabin astern for the captain, about the size of a dog kennel, but the boats have no other sleeping accommodation. The paddles with which the rowers propel the vessel are shaped rather curiously, looking at a distance like mere sticks with flat disks of wood fastened to their ends. The boats are steered by an oar rudder at the starboard side of the stern, and each is furnished with a mast and huge sail, which can be raised in a few minutes and struck in almost as many seconds. Although the Illinoans are wealthy tribes, and possess quantities of fire-arms, they are rather afraid to use these weapons, and trust in preference to the spear and parang.

The Illinoans were instrumental in the murder of two native chiefs who were friendly to the English, and who had been suspected of aiding the cession of Labuan. One of them, named Bud-ruddeen, a man of celebrity as a warrior, did not fall unavenged. When the enemy approached he re-

tired to his house, together with his favorite wife and his sister, neither of whom would leave him. By the aid of his followers, he fought desperately to the very last, until nearly all his men were killed, and he himself was dangerously wounded. He then retired with his wife and sister into an inner chamber, while the enemy crowded into the house in search of him,



AN ILLINOAN PIRATE AND SAGHAI DYAK.

and then, firing his pistol into a barrel of gunpowder which he had placed there in readiness, blew to pieces himself, his two relatives, and his enemies.

The other figure represents a Saghai Dyak. This tribe lives on the south-eastern coast of Borneo, and is remarkable for the superb costumes of the men, who have about them an air of barbaric splendor, which they

are exceedingly fond of displaying. Wearing in common with all Dyaks, the chawat or waist cloth, they take a pride in adorning themselves with short tunics made of tiger or leopard skin, or rich and embroidered cloth; while on their heads they wear magnificent caps made of monkey-skin, and decorated with the beautiful feathers of the Argus pheasant, two of the largest feathers being placed so that one droops over each ear. All these Dyaks have a very singular profile, in consequence of their habit of filing their teeth and so reducing their bulk, those who have concave teeth presenting the most curious outline.

Comparatively slight and feeble as the Dyaks look by the side of the stalwart and muscular European, their strength is really wonderful, and enables them to perform tasks which the powerful white man could not by any possibility achieve. On a journey, when a European has fallen from sheer fatigue, a Dyak has taken the burden with which the fallen man was laden, and added it to his own, without seeming to display any particular sense of having increased his own labor; and when the stranger, in spite of the relief, has lain down in absolute inability to move, a little wiry Dyak, has picked him up, put him on his back, and proceeded on his journey with perfect ease.

Amazing Strength of Little Dyaks.

The Dyaks are able, in some astonishing manner, to penetrate with comparative ease through jungles which are absolutely impervious to Europeans. One of these men, while on the march with some English soldiers, exhibited his strength in a very unexpected manner. The path was a terrible one, all up and down steep and slippery hills, so that the Chinese coolies who accompanied the party first threw away their rice, and lastly sat down and wept like children. The English sergeant, a veteran, accustomed to hard marching, both in China and India, broke down at the first hill, and declared his inability to move another step under the load which he carried. The commander of the party asked one of the Dyaks to carry the sergeant's burden, and promised him an additional piece of tobacco. The man was delighted with the proposal, and accepted it. He was already carrying food for three weeks, his whole store of clothes, one twelve-pound shot, two twelve-pound cartridges, a double-barrelled gun, a hundred rounds of ball cartridge, and his own heavy sword and spear. Such a load as this, which would be almost too great even for a man walking on good roads, seemed a mere trifle to the agile Dyak, who went lightly and easily up and down paths which the foreigners could hardly traverse even without having to carry anything except their own weight.

So little indeed, was he incommoded, that he strapped the whole of the sergeant's kit on his back, and walked off as easily as if the whole load were but a feather weight. No one who has not actually traversed those paths can form an idea of the miseries attending the journey. The paths themselves are bad enough, but in addition to the terribly severe labor of walking, the traveller has to endure mosquitoes, sand-flies, intense heat at mid-day, and intense cold at night, thirst, wet, and every imaginable discomfort.

Yet the native seems quite easy in the journey, and gets over the ground in a manner that is absolutely exasperating to foreigners who accompany him. He is able to push his way through prickly thickets and morasses in a way which seems almost impenetrable. Indeed, he says himself that it is impenetrable, and that he achieves these feats by means of certain charms which he carries about with him.

Physical Feats of Savage Tribes.

The extraordinary agility of the natives of Borneo finds a rival in the physical endurance and remarkable nimbleness of our own Indian tribes. The game which is most characteristic of the American Indians is the celebrated ball game, a modification of which goes under the name of *La Crosse*. The principle on which it is played is exactly that of foot-ball and hockey, namely, the driving of a ball through a goal defended by the opposite party. We will describe the game as it is played by the *Choc-taws*.

A ball is carefully made of white willow wood and ornamented with curious designs drawn upon it with a hot iron. The ball-sticks, or racquets, are much like our own racquets, but with larger and more slender handles, and with a very much smaller hoop. Each player carries two of these sticks, one in each hand. The dress of the players is very simple, being reduced to the waist-cloth, a tail made of white horse-hair or quills, and a mane of dyed horse-hair round the neck. The belt by which the tail is sustained may be as highly ornamented as possible, and the player may paint himself as brilliantly as he likes, but no other article of clothing is allowed, not even moccasins on the feet.

On the evening of the appointed day, the two parties repair to the ground where the goals have already been set up, some two hundred yards apart, and there perform the ball-play dance by torchlight. Exactly in the middle between the goals, where the ball is to be started, sit four old medicine men, singing and beating their drums, while the players are clustered round their respective goals, singing at the top of their voices, and rattling their ball-sticks together. This dance goes on dur-

ing the whole of the night, so that the players are totally deprived of rest—a very bad preparation, as one would think, for the severe exertion of the ensuing day. All the bets are made on this night, the article staked, such as knives, blankets, guns, cooking utensils, tobacco, and even horses and dogs, being placed in the custody of the stakeholders, who sit by them and watch them all night.

The Exciting Contest Begins.

About nine o'clock on the next morning the play begins. The four medicine men, with the ball in their custody, seat themselves as before, midway between the goals, while the players arrange themselves for the attack and defence. At a given signal the ball is flung high in the air, and as it falls, the two opposing sets of players converge upon it. As there are often several hundred players on each side, it may be imagined that the scene is a most animated one.

In these desperate struggles for the ball, where hundreds are running together, and leaping actually over each other's heads, and darting between their adversaries' legs, tripping, and throwing, and foiling each other in every possible manner, and every voice raised to its highest key, in shrill yelps and barks, there are rapid successions of feats and incidents that astonish and amuse far beyond the conception of any one who has not had the singular good luck to witness them.

In these struggles, every mode is used that can be devised to oppose the progress of the foremost, who is likely to get the ball; and these obstructions often meet desperate individual resistance, which terminates in a violent scuffle, and sometimes in fisticuffs. Then their sticks are dropped, and the parties are unmolested, whilst they are settling it between themselves, except by a general stampede to which those are subject who are down, if the ball happen to pass in their direction. Every weapon, by a rule of all ball players, is laid by in the respective encampments, and no man is allowed to go for one; so that the sudden broils that take place on the ground are presumed to be as suddenly settled without any probability of personal injury, and no one is allowed to interfere in any way with the contentious individuals.

A Very Lively Scrimmage.

There are times when the ball gets to the ground, and such a confused mass is rushing together around it, and knocking their sticks together without a possibility of anyone getting or seeing it for the dust that they raise, that the spectator loses his strength, and everything but his senses; when the condensed mass of ball sticks and shins and bloody noses is carried around the different parts of the ground, for a quarter of an hour at a

time, without any one of the masses being able to see the ball, which they are often scuffling for several minutes after it has been thrown off and played over another part of the ground.

For each time that the ball was passed between the goals of either party, one was counted for their game, and they halted for about one minute when the ball was again started by the judges of the play, and a similar struggle ensued; and so on until the successful party arrived at



AN EXCITING INDIAN BALL GAME.

100, which was the limit of the play, when they took the stakes. In this game the players are not allowed to strike the ball with their sticks, or catch it in their hands; though to do so between the netted ends of the sticks, and then to run away with it, is a feat which each player tries his best to accomplish.

Sometimes the men are kind enough to indulge the women with a ball-play, and to present a quantity of goods as prizes, hanging them across a horizontal pole, in order to stimulate the players by the sight. Such

inferior beings as women are not, however, allowed to use the ball and racquet of their superiors, the men, but play with a couple of small bags filled with sand, and attached to each other by means of a string about eighteen inches in length. Each of the players is furnished with two slight sticks, about two feet in length, and with these sticks they dexterously catch the sand bags, and fling them toward the goals. The women play with quite as much enthusiasm as the men, and the game often assumes the appearance of a general battle rather than of a pastime.

A Remarkable Old Hunter.

The strength and agility which characterize the savage tribes extend in many instances into advanced age, so that at a period of life when civilized races would expect only feebleness and bodily decay, we find those races which live nearest to a state of nature exhibiting surprising bodily vigor. Baker, in his animated narrative of his travels through Africa, gives a picturesque description of an old native engaged in the dangerous pursuit of hunting the hippopotamus.

He says: One of the old Hamran hunters, named Abou Do—an abbreviated version of a very long string of names—was celebrated as a howarti, or hippopotamus hunter. This fine old man, some seventy years of age, was one of the finest conceivable specimens of humanity. In spite of his great age, his tall form, six feet two in height, was as straight as in early youth, his gray locks hung in thick curls over his shoulders, and his bronze features were those of an ancient statue. Despising all encumbrances of dress, he stepped from rock to rock as lightly as a goat, and, dripping with water, and bearing his spear in his hand, he looked a very Neptune. The hunters came upon a herd of hippopotami in a pool, but found that they were too much awake to be safely attacked.

The Veteran Plunges into the Torrents.

About half a mile below this spot, as we clambered over the intervening rocks through a gorge which formed a powerful rapid, I observed, in a small pool just below the rapid, an immense head of a hippopotamus close to a perpendicular rock that formed a wall to the river, about six feet above the surface. I pointed out the hippo to old Abou Do, who had not seen it. At once the gravity of the old Arab disappeared, and the energy of the hunter was exhibited as he motioned us to remain, while he ran nimbly behind the thick screen of bushes for about a hundred and fifty yards below the spot where the hippo was unconsciously basking, with his head above the surface. Plunging into the rapid torrent, the veteran hunter was carried some distance down the stream, but, breasting the powerful current, he landed upon the rocks on the opposite

side, and, retiring to some distance from the river, he quickly advanced toward the spot beneath which the hippopotamus was lying. I had a fine view of the scene, as I was lying concealed exactly opposite the hippo, who had disappeared beneath the water.

Abou Do now stealthily approached the ledge of rock beneath which he had expected to see the head of the animal; his long, sinewy arm was



THE OLD ARAB ATTACKING THE HIPPOPOTAMUS.

raised, with the harpoon ready to strike as he carefully advanced. At length he reached the edge of the perpendicular rock, the hippo had vanished, but, far from exhibiting surprise, the old Arab remained standing on the sharp ledge, unchanged in attitude.

No figure of bronze could have been more rigid than that of the old river-king, as he stood erect upon the rock with the left foot advanced,

and the harpoon poised in his ready right hand above his head, while in the left he held the loose coils of rope attached to the ambatch buoy. For about three minutes he stood like a statue, gazing intently into the clear and deep water beneath his feet.

I watched eagerly for the reappearance of the hippo; the surface of the water was still barren, when suddenly the right arm of the statue descended like lightning, and the harpoon shot perpendicularly into the pool with the speed of an arrow. What river-fiend answered to the summons? In an instant an enormous pair of open jaws appeared, followed by the ungainly head and form of the furious hippopotamus, who, springing half out of the water, lashed the river into a foam, and, disdaining the concealment of the deep pool, he charged straight up the violent rapids. With extraordinary power he breasted the descending stream; gaining a footing in the rapids, about five feet deep, he ploughed his way against the broken waves, sending them in showers of spray upon all sides, and upon gaining broader shallows he tore along through the water, with the buoyant float hopping behind him along the surface, until he landed from the river, started at full gallop along the dry shingly bed, and at length disappeared in the thorny jungle.

The Maddened Beast Charging at His Foes.

During one of these flights, the hippopotamus took it into his head, that the ambatch float was the enemy that was damaging him, and attacked it furiously. Taking advantage of his pre-occupation, two hunters swam across the river, carrying with them a very long and tough rope, and holding one end on each bank and "sweeping," as the sailors say, they soon caught the float in the centre of the rope and brought it ashore. The hippopotamus then made a charge, and the slackened line was immediately coiled round a rock, while two hunters fixed additional harpoons in the animal; and though he made six charges at his foes, bit one of the ropes asunder, and crushed the lance-shafts between his teeth like straws, the hardy hunters got the better of him, and his death was only a matter of time.

In the water, the crocodile is even a more dangerous antagonist than the hippopotamus, and yet the Hamrans attack it with their harpoons, boldly entering the water, and caring no more for crocodiles than for so many frogs.

The great agility of some savage tribes is wonderfully displayed in their various dances, many of which, while being wild and grotesque, are yet such as to astonish the beholder. A traveller gives us a vivid picture of a scene witnessed once among the Dyaks. Two warriors had been

EXPERT DANCERS AMUSING SPECTATORS.



dancing in a ring when, according to custom, human heads just captured in battle were suddenly presented.

The appearance of the heads was a sign for the music to play louder, for the war cry of the natives to be more energetic, and for the screams of the dancers to be more piercing. Their motions now became more rapid, and the excitement in proportion. Their eyes glistened with unwonted brightness, the perspiration dropped down their faces; and thus did yelling, dancing, gongs, and tom-toms become more rapid and more violent every minute, till the dancing warriors were ready to drop. A farewell yell, with emphasis, was given by the surrounding warriors; immediately the music ceased, the dancers disappeared, and the tumultuous excitement and noise were succeeded by a dead silence.

A quarter of an hour elapsed, and the preparations were made for another martial dance. This was performed by two of the Rajah's sons. They came forward, each having on his arm one of the large Dyak shields, and in the centre of the cleared space were two long swords lying on the floor. The ceremony of shaking hands was gone through; the music then struck up, and they entered the arena.

Nimble Movements and Loud War Cries.

At first they confined themselves to evolutions of defence, springing from one side to the other with wonderful quickness, keeping their shields in front of them, falling on one knee, and performing various feats of agility. After a short time, they each seized a sword and then the display was very remarkable, and proved what ugly customers they must be in single conflict. Blows in every direction, feints of every description, were made by both, but invariably received upon the shield. Cumbersome as these shields were, no opening was left; retreating, pursuing, dodging, and striking, the body was never exposed.

Occasionally, during this performance, the war cry was given by the surrounding warriors, but the combatants held their peace; in fact, they could not afford to open their mouths, lest a point should be exposed. It was a most masterly performance.

After a while these performers became too tired to proceed without refreshment, and their place was taken by four or five others, carrying blocks of wood having a feather at each end. The foreign guests took these objects to represent canoes, but were told that they were rhinoceros hornbills, and were thought by all competent judges to be fine works of art. Suddenly a number of gongs were beaten, and over the mass of human beings arose swords, heads, rhinoceros hornbills, and cat-o-nine-tails in profusion, the Dyaks being for the time half mad with excitement.

CHAPTER VII.

CURIOSITIES OF THE ANIMAL KINGDOM.

Wonderful Revelations in Natural History—Vast Multitudes of Living Creatures—Earth, Air and Water the Home of Life—Colossal Monsters of Forest and Jungle—The Towering Giraffe—Ludicrous Movements—A Beautiful Creature—Power of Self-Defense—The Giraffe in the Old Roman Circus—A Swift Chase and Capture—The Striped Zebra—The Most Beautiful of Quadrupeds—The King of Portugal and his Four Zebras—A Creature Hard to be Tamed—Animal Sacrifices in Eastern Countries—The Ponderous Rhinoceros—Made to Fight in the Roman Colosseum—A Monster Almost Iron-Plated—Haunts of the Clumsy Beast—Hunting the Rhinoceros—Fatal Stroke with a Sword—Story of a Terrible Encounter—The Voracious Crocodiles—Killed at Roman Games—Arabs Wounded by Crocodiles—A Friendly Bird—The Attack with a Dagger—The Famous Gavia of India—A Reptile on Wings—The Flying Frog—A Reptile with Exquisite Colors.



HAVING given a full description of the antediluvian world and the singular animals—monsters they may truly be called—which inhabited it; having depicted the extraordinary changes which have been going on for many ages, resulting in the formation of our globe as we see it at the present time; having witnessed the great convulsions which have desolated cities and destroyed multitudes of human beings, and beheld the fiery outburst of volcanoes with their startling phenomena; having traversed distant realms and observed the curious features in the life of savage tribes, we are now to turn our attention to the animal creation in its present aspects, and notice the latest and most extraordinary developments in the great realm of natural history.

In whatever direction we turn our eyes, we everywhere meet the varied forms of animal life. Earth, air, water, are all alike occupied by multitudes of living creatures, each fitted especially for the habitation assigned to it by nature. Every wood or meadow, every tree or shrub, or tuft of grass has its inhabitants; even beneath the surface of the ground, numbers of animals may be found fulfilling the purposes for which their species were called into existence. Myriads of birds dash through the air, supported on their feathered pinions, or solicit our attention by the charming song which they pour forth from their resting-places; while swarms of insects, with still lighter wings, dispute with them the empire

of the air. The waters, whether salt or fresh, are also filled with living organisms; fishes of many forms and varied colors, and creatures of yet more strange appearance, swim silently through their depths, and their shores are covered with a profusion of polypes, sponges, star-fishes, and other animals. To whatever elevation we attain on the mountain-sides, to whatever depth in the ocean we may sink the lead, everywhere shall we find traces of animal existence, everywhere find ourselves surrounded by living creatures, in a profusion and variety which may well excite our wonder and admiration.

Nor are these phenomena confined to any region of the earth; on the contrary, the diversity of climate only adds to the variety of objects which the zoologist is called upon to contemplate. Thus the bold voyager of the inclement regions of the North, in losing sight of those productions of nature which met his eyes at home, finds, as it were, a new creation in his new abode,—seals, by the hundred, basking in the scanty rays of the Arctic sun, or diving into the deep waters in search of their finny prey, and the whale, rolling his vast bulk in the waves, and ever and anon driving high into the air his curious fountain of spray. The air is peopled by innumerable flights of marine birds; the sea by still more countless swarms of fishes; and the land affords a habitation to the elk and the reindeer, the Arctic fox, and other creatures peculiar to those regions.

Amazing Abundance of Animal Life.

If we turn our steps southward, to the tropical regions of the earth, the abundance and variety of animated beings increase more and more. Here the colossal elephant and the unwieldy rhinoceros, crash through primeval forests; the lion and the tiger, and other predatory beasts, prowl through the thickets, seeking for their prey; on vast plains, countless herds of antelopes browse in fancied security, or dash swiftly past at the approach of danger; gigantic snakes lie coiled in horrid folds among the bushes, or hang from the trees awaiting their victims. The air and trees swarm with birds of gorgeous plumage, and insects of strange forms and brilliant colors. Nor are the waters less bountifully provided with inhabitants: every form with which we are acquainted in our own seas is here represented, but with still greater profusion and variety.

Full nature swarms with life.

Through subterranean cells,
Where searching sunbeams scarce can find a way,
Earth animated heaves. The flowery leaf
Wants not its soft inhabitants. Secure
Within its winding citadel, the stone

Holds multitudes. But chief, the forest boughs,
That dance unnumbered to the playful breeze.
The downy orchard and the melting pulp
Of mellow fruit, the nameless nations feed
Of evanescent insects. Where the pool
Stands mantled o'er with green, invisible,
Amid the floating verdure, millions stray.

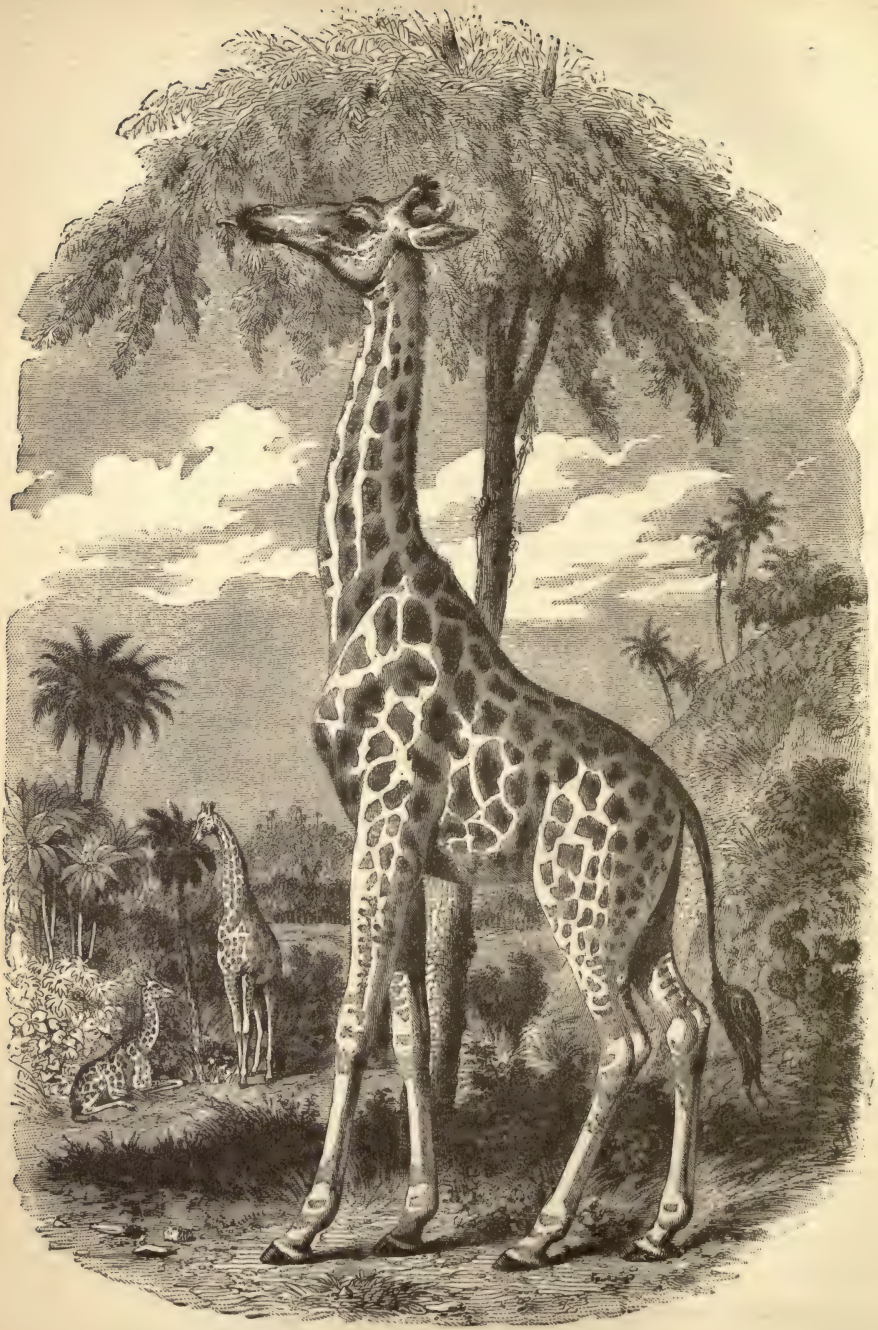
Thus we are encompassed with the marvelous. On every hand there are creations, some of extraordinary magnitude, others of surprising minuteness, which awaken our curiosity; and in studying these varied forms of life we find a new wonder at every step.

An Animal of Remarkable Height and Beauty.

It makes little difference where we begin in our delineation. We will take a trip to the tropics, and get a view of one of its most curious and interesting animals—the giraffe. The giraffe—which has been humorously described as “an antelope run to seed”—is fond of a wooded country. The leaves of trees are its principal food, and especially a species of mimosa. Green herbs are also very agreeable to it; but its structure does not admit of its feeding on them in the same manner as our domestic animals, the ox or the horse. It is obliged to straddle widely; its two fore feet are gradually stretched widely apart from each other, and its neck, being then bent into a semicircular form, the giraffe is thus enabled to collect the grass. The tongue, also, has the power of motion to an extraordinary degree, and, at the same time, one of extension, so as to perform, in miniature, the office of an elephant's proboscis. Coiling this member round the branches of trees, it draws them down between its very movable and flexible lips, and thus nips off the tender portions. The tongue can taper to a point, and is capable of being formed into a ring.

This remarkable animal is distinguished from all the other ruminants or cud-chewing animals, by several important characteristics. The body is short and supported upon very long legs; the dorsal line slopes downward toward the rump, the withers being greatly elevated, and from this it was long confidently asserted that the fore-legs were much longer than the hinder pair, although this is not the case. The neck is excessively long, and the countenance exceedingly gentle and pleasing in its expression, the eyes being remarkably full and lustrous. The giraffe is the tallest of all ruminants, the males not uncommonly measuring fourteen and sometimes eighteen feet from the top of the head to the ground. The females are usually a foot or two shorter.

The giraffe is not a very swift animal, and when pursued its gallop is described as exceedingly ludicrous, the hind-legs being brought forward



THE GIRAFFE OR CAMELOPARD.

at each step completely in advance of the anterior ones, apparently a foot or two on the outside of them; in this fashion the giraffes contrive to get over the ground pretty rapidly, with a curious springing motion. A very swift horse may possibly overtake them, and the rider may then select his victim from the herd, cut it off from its companions, and shoot it at his leisure. When going at full speed the heels of the giraffe constantly throw up dirt, sticks, and stones in the faces of its nearest pursuers, but it never appears to attempt to defend itself unless brought to bay; in this case its weapons are its hoofs, with which it kicks out so rapidly and vigorously that dogs will not venture to attack it, and it is even said that it can beat off the lion in the same manner. The flesh of these animals, when young, is considered very good; that of the old ones is coarse. The skin is very thick and highly valued by the natives of South Africa, who consider the leather formed from it to be the best material for sandal soles. They also use the skin in the formation of vessels to hold water, and sometimes as a covering for their huts.

Colossal Size and Grace of Movement.

Cumming gives us the following lively description of the giraffe, at liberty in his native regions:

These gigantic and exquisitely beautiful animals, which are admirably formed by nature to adorn the forests that clothe the boundless plains of the interior, are widely distributed throughout the interior of Southern Africa, but are nowhere to be met with in great numbers. In countries unmolested by the intrusive foot of man, the giraffe is found generally in herds varying from twelve to sixteen; but I have not unfrequently met with herds containing thirty individuals, and on one occasion I counted forty together; this, however, was owing to chance, and about sixteen may be reckoned as the average number of a herd. These herds are composed of giraffes of various sizes, from the young giraffe of nine or ten feet in height, to the dark chestnut-colored old bull of the herd, whose exalted head towers above his companions. Some writers have discovered ugliness and a want of grace in the giraffe, but I consider that he is one of the most strikingly beautiful animals in the creation; and when a herd of them is seen scattered through a grove of the picturesque parasol-topped acacias which adorn their native plains, and on whose uppermost shoots they are enabled to browse by the colossal height with which nature has so admirably endowed them, he must, indeed, be slow of conception who fails to discover both grace and dignity in all their movements.

It is very difficult, almost impossible, to take a mature giraffe alive; for they run with such speed and with a succession of such wonderful

bounds, that the swiftest horses can scarcely overtake them. In order to capture them, the period when the young are sucklings is selected, when, if the captor is fortunate enough to keep the youngster alive for a few days, it becomes quiet, and even tame; but very often the poor captive refuses all nourishment, and dies of consumption.

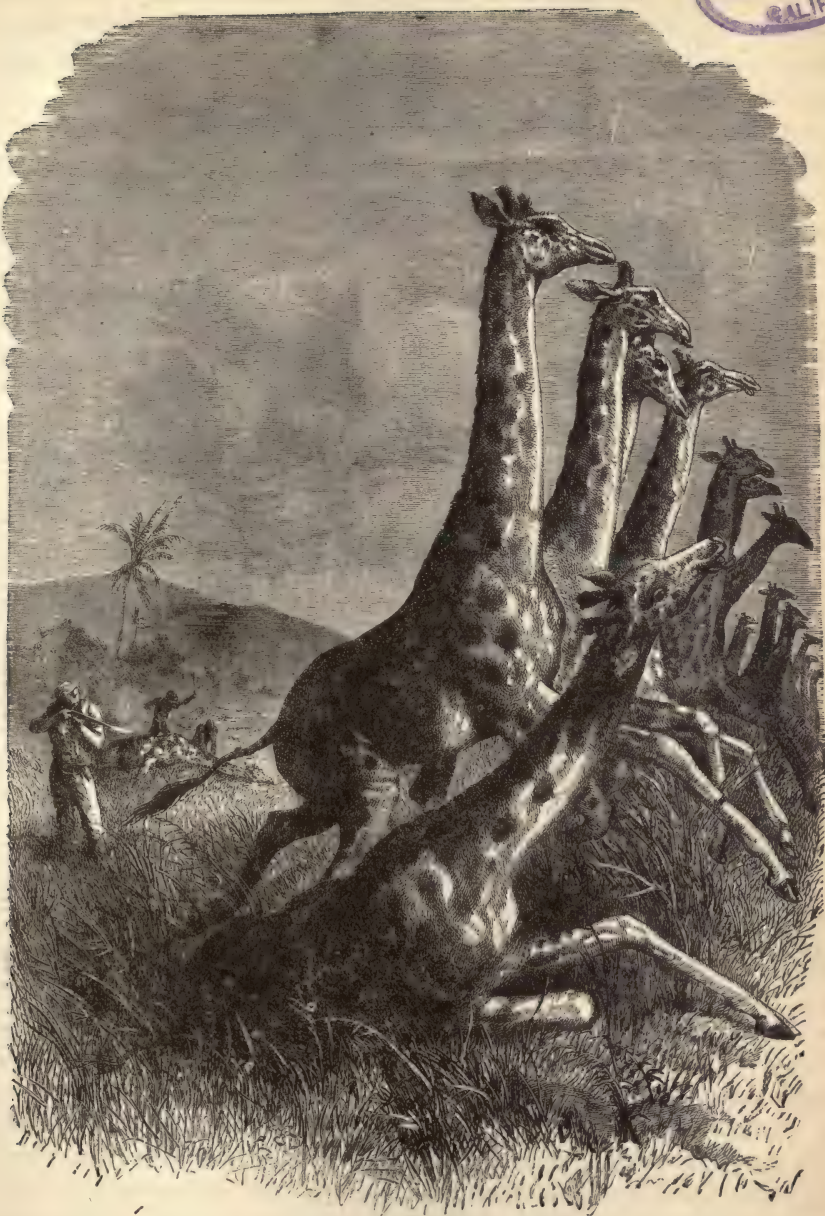
The Foes of the Giraffe.

The chief enemies of the giraffe are the lion and panther. In the open plain it distances them with ease; but if it is surprised from ambush, it exhibits both courage and strength in resisting its assailant, striking with its forefeet with such force as to prove occasionally fatal to the foe; but too frequently its efforts are unavailing. The giraffe must number man also among its enemies. The Hottentots hold its flesh in high esteem. By lying in wait for it at a favorite feeding or watering-place they shoot it with poisoned arrows. The more frequent use of fire-arms in hunting this beautiful animal will certainly before long lead to a complete annihilation of these wonderful and docile creatures.

The ancients were acquainted with the giraffe. In the Egyptian paintings or bas-reliefs which have been handed down to us, there are figures which represent it; Pliny, Oppian, and Heliodorus also make mention of it. The Romans possessed living specimens of this animal, which they exhibited in their circuses, and it appeared in the procession of the "Triumph." Several giraffes were introduced into Europe during the middle ages. Buffon was unable personally to examine this animal; but the illustrious traveller, Levaillant, who died almost in poverty, after having sacrificed his fortune to long and perilous journeys in Africa, sent the Zoological Garden, at Paris, the first stuffed giraffe which that institution possessed.

A Successful Capture.

Levaillant thus gives a description of the chase by which he became possessed of this rare animal: I began one day to hunt at sunrise, in the hope of finding game to add to my provisions. After hours of riding, I perceived on a brow of a hill seven giraffes, which my dogs immediately attacked. Six of these immediately took flight in the same direction, but the seventh, surrounded by my hounds, went off another way. At this moment my companion was walking and leading his horse by the bridle; in less than a second, he was in his saddle and pursuing the herd. I followed the single one with all speed; but, notwithstanding the efforts of my horse, it gained so much on me that, on turning a corner of a hillock, it was quite out of sight, so I relinquished the pursuit. My dogs, however, were not long in reaching it; for they soon came so near as to force



A LIVELY CHASE FOR GIRAFFES.

it to come to a halt to defend itself. From where I was I heard them baying ; and as the sounds seemed all to come from the same place, I conjectured that the hounds had driven it into a corner, so immediately hurried towards the spot.

I had scarcely reached the top of the acclivity, when I perceived the giraffe surrounded, and endeavoring to keep off its assailants, by kicking. Having dismounted, with one shot from my rifle I knocked it over. Delighted with my victory, I was returning on foot to call my people round me to skin and cut up the animal. While I was looking for them I saw a native, who was eagerly making signs to me, which at first I could not in the least understand. But on looking in the direction in which he was pointing, I perceived, with surprise, a giraffe standing up under a large ebony tree, and attacked by my dogs. I thought it was another one, and ran towards it, but found it was the animal I had first attacked, which had managed to get up again, but fell down dead just as I was about to fire a second shot.

Who would believe that a success like this could excite in my mind transports of joy almost akin to madness ! Pain, fatigue, cruel want, uncertainty as to the future, and disgust at the past, all vanished, at the sight of my rare prize ; I could not look at it enough. I measured its enormous height, and gazed with astonishment from the instrument of destruction to the animal destroyed by it. I called and recalled my people, one by one ; and though each of them might have been able to do as much, and we had all slaughtered heavier and more dangerous animals, yet I was the first to kill one of this particular kind ; with it I was about to enrich natural history, and, putting an end to fiction, establish the truth.

An Animal Elegantly Formed and Marked.

The zebra, sometimes called the horse-tiger, is generally esteemed not only the most beautiful of the equine family, but one of the most beautiful of quadrupeds, on account of the markings of its skin. The ground color is white, or yellowish-white, but the head, body, and legs to the hoofs are regularly striped, mostly crosswise, with deep brown-black bands, lighter in the middle. From this form of marking we have the word *zebraed*, significant of a regular banding of the skin of an animal. The ears of the zebra are long, the neck short and deep, with a sort of dewlap under the throat, produced by a loose fold of the skin ; the mane is short, and the tail sparsely clad with long hair. The form resembles that of the ass, but the size nearly equals that of the horse. Wild and swift, this species lives in troops in the bold ranges of craggy mountains remote from the abode of man. Its disposition is



WILD ZEBRAS OF SOUTHERN AFRICA.

savage and intractable, and it is by no means easily obtained, not only from its fleetness, but from the nature of the localities it frequents, where, like the wild ass of Thibet, in the "wilderness and the barren land is his dwelling; he scorneth the multitude of the city." Nevertheless, zebras have been taken to Europe and placed in the menageries. All attempts to domesticate them, or to train them to the service of man, have failed; about a century ago, however, the King of Portugal had four of them, which he sometimes drove harnessed to his carriage.

The zebra is larger than the wild ass, sometimes attaining the size of a mature Arab horse. This elegant animal is a native of the Cape of Good Hope, and probably the whole of southern, and a part of eastern, Africa. Travellers state that they have met with it in Congo, Guinea, and Abyssinia. It delights in mountainous countries, and, although it is less rapid than the wild ass, its paces are so good that the best horses are alone able to overtake it. The zebra lives in droves, but is very shy in its nature; it is endowed with powers of sight that enable it to perceive from great distances the approach of hunters. It is, consequently, very difficult to capture a mature living specimen.

That it is impossible to reduce this quadruped to a domestic state is currently believed. In contradiction, we would state that a female zebra, which had been caught young, and sent by the Governor of the Cape of Good Hope to the Zoological Gardens in Paris, was so tractable that it allowed itself to be approached and led almost as readily as a horse. The zebra was not unknown to the ancients, who called it *hippo-tigris*. A historian relates that the Emperor Caracalla killed on a certain day, in one of the circus combats, an elephant, a rhinoceros, a tiger, and a *hippo-tigris*. Diodorus of Sicily speaks of the *hippo-tigris*, although in rather obscure terms. The kings of Persia, during certain religious festivals, were accustomed to sacrifice zebras to the sun, a stock of which were kept by these potentates in some of the islands of the Red Sea.

The Zebra's Native Country.

The zebra is only to be met with in the most eastern and the most southern parts of Africa, from Ethiopia to the Cape of Good Hope, and thence to Congo; it exists neither in Europe, Asia nor America, nor even in all the northern parts of Africa; those which some travellers tell us they have seen at the Brazils have been transported thither from Africa; those which others are reported to have seen in Persia, and in Turkey, have been brought from Ethiopia; and, in short, those that we have seen in our own country are almost all from the Cape of Good Hope. This point of Africa is their true climate, their native country, and where the

Dutch have employed all their care to subject them and to render them tame, without having been hitherto able to succeed. One that was captured was very wild when he arrived at the royal menagerie in France; and he was never entirely tamed: nevertheless, he was broken for the saddle; but two men held the bridle, while a third mounted him. The mouth of the zebra is very hard; his ears so sensitive, that he winces whenever any person goes to touch them. He is restive, like a vicious horse, and obstinate as a mule; but there is reason to believe, that if the zebra were accustomed to obedience and tameness from his earliest years he would become as mild as the horse, and might be substituted in his place.

The Horned Rhinoceros.

Now that we are describing the marvels of animal life in the tropics, there is another singular quadruped, a monstrous creature, that deserves especial mention. Rhinoceroses were much more numerous in remote eras than they are at present. There have existed numerous different species, several of them living in temperate and even in cold climates—as France, Germany, and Russia. These animals are no longer found, except in the hottest portions of the old World. Aristotle says nothing of the Rhinoceros; but Athenæus, Pliny, and Strabo mention it in their works. The first Rhinoceros mentioned in history figured in a *fête* given in Egypt by one of the Kings. Later, Pompey, Augustus, the emperors Antoninus and Heliogabalus, brought some into Europe, and made them fight in the Coliseum, at Rome, sometimes with the hippopotamus, and sometimes with the elephant. We must then pass on to the sixteenth century to find in European history any new mention of these animals. In 1513, Emanuel, the King of Portugal, received from India a one-horned rhinoceros. Albert Durer made an engraving of it on wood, which was for a long time copied and reproduced in works on natural history. Only this representation of it is very inexact; for Albert Durer had executed it after an incorrect drawing sent him from Lisbon into Germany. During the eighteenth century, a rhinoceros was brought to Holland; two were taken to London at the end of the same century. The menagerie at Versailles bought one of these last-named animals, which very soon died. Since the beginning of our century civilized nations have received many of these gigantic and curious quadrupeds.

The great Indian rhinoceros inhabits the regions situated beyond the Ganges, and especially the valley of Opam, along the base of the eastern Himalaya Mountains. Its head is short and triangular; its mouth, of a moderate size, has an upper lip, which is longer than the lower, pointed

and movable. It has in each jaw two strong incisive teeth. Its eyes are small ; its ears are rather long and movable. The horn upon its nose is pointed, conical, not compressed, sometimes two feet in length, and



THE INDIAN RHINOCEROS.

slightly curved backwards. This singular weapon is composed of a cluster of hairs closely adherent ; for when the point is blunted, it is often seen divided into fibres resembling the hairs of a brush. This horn is,

however, very solid, hard, of a brownish red on the outside, of a golden yellow inside, and black in the centre.

A Ponderous Armor.

The neck of this animal is short and covered with folds and creases. Its shoulders are thick-set and heavy ; its ponderous body is covered with a skin remarkable for the deep wrinkles or creases with which it is furrowed, backwards and across the forequarters, and across the thighs. Thus, as it were, to all appearance cut up into plaits of mail, the great Indian rhinoceros seems to be covered with a cloak made for it. This cloak has, indeed, been compared to a suit of armor of well adjusted pieces. The hide is, however, so thick and hard that, without these creases or folds, the animal, imprisoned, as it were, in its armor could scarcely move. It is of a dark color, nearly bare, generally provided only with a few coarse and stiff hairs on the tail and ears, occasionally with curly woolly hairs on certain parts of the body.

The great Indian rhinoceros is heavy and more massive than even the elephant, on account of the shortness of its limbs. The feet have each three toes, of which one sees nothing but the hoof which covers them. The tail is short and thin. This huge creature lives alone in the forests and near rivers and marshes, because it is fond of wallowing in the mud, like the wild boar, which it sometimes resembles in its habits. Though such a powerful animal, it rarely attacks before it is interfered with ; the other large animals fear it, and consequently leave it unmolested. Its horn only serves it for moving branches out of its way and for clearing a road for itself in the thickets, in the midst of which it passes its taciturn existence. Some naturalists have said that it uses its tusks for tearing up the roots on which it is fond of feeding ; but in order to turn up the soil, the animal, from the position of its horn and from the horn being curved backwards, would be obliged to assume an attitude which the shortness of its neck and its general conformation render impossible. A wounded rhinoceros of this species has been seen to cut the reeds on either side of it as perfectly as if done with the sharpest incisive instrument.

An Untameable Beast.

Its principal food consists of roots, of succulent plants, and of small branches of trees, which it tears off, seizes, and breaks with its upper lip, which is elongated and movable, and which it uses with great adroitness, almost in the same way in which the elephant uses its trunk. When it is kept in a state of captivity it eats bread, rice, bran soaked in water, hay, and carrots. Its clumsy shape, its short legs, its belly almost touching the ground, render this animal very ugly and ill-favored. Its diminutive

eyes seem to indicate a low order of intelligence. And so the rhinoceros is a dull beast, brusque, and almost untameable. When it is not irritated, its voice has a great analogy to the grunting of a pig; if it is angered it utters sharp, piercing cries, that can be heard at great distances.

In India, in former times, the rhinoceros was hunted on light, quick horses. The huntsmen followed it from afar off, and without any noise, till the animal became tired and was obliged to lie down and sleep. Then the sportsmen approached it, taking care to keep to leeward, for it has a very acute sense of smell. When they were within shot, they dismounted, aimed at the head, fired, and galloped away; for if the rhinoceros is only wounded, it rushes furiously upon its aggressors. When struck by a bullet, it abandons itself wholly to rage. It rushes straight forward, smashing, overturning, trampling under foot, and crushing to atoms everything which is unfortunate enough to be in its road. Its pursuers can avoid these formidable attacks by making digressions to the right or left, for the course taken by the rhinoceros is always straight ahead, never turning out of its direction or retracing its steps.

A Dangerous Pastime.

If the Indians dare to run the risks involved in such dangerous sport, it is because the skin and horn of the animal are of great value. Sportsmen also find the skin of the rhinoceros of utility: it is made into leather, which is so hard that it can only be cut with great difficulty by the best steel. The Indians like the flesh of the rhinoceros; but the Chinese are excessively fond of it. After swallows' nests, lizards' eggs, and little dogs, there is nothing to be compared, according to the Chinese, to the tail of a rhinoceros, or to a jelly made from the skin. Let us add, that the Chinese attribute to the horn of this pachyderm marvelous properties, among others that of destroying the effects of the most deadly poisons. The Asiatic kings, who had too often to be afraid of poisoned beverages, had their drinking-cups made of the horn of the rhinoceros; these cups were considered by them of inestimable value.

In menageries, the Asiatic rhinoceros is generally a gloomy, but a mild and obedient animal. But sometimes the constraint in which it is retained gives it fits of impatience and fury, when it becomes dangerous. In its despair it has been known to dash its head violently against the walls of its stable. Generally, however, it recognizes its keeper's authority, and shows itself conscious of his presence and grateful to him for his care. The African rhinoceros was known to the ancients, for its effigy is found on medals struck in the time of the Emperor Domitian. It has on its nose two conical horns, inclined backwards. The foremost horn is

two and a half feet long, the second much shorter. Hidden during the day, it sallies out at night, to eat the young boughs covered with leaves. After feeding it wallows, covering itself with repeated layers of mud, to preserve it from the sting of the gad-flies—its small but troublesome enemies. When the mud is dry, it falls off, exposing the animal to fresh attacks. To allay the irritation caused by these annoying insects, it rubs itself against the trunks of trees, and during this operation it grumbles and grunts so loudly that it betrays its place of retreat to the hunters, who attack it and kill it by shooting arrows into its flank, the most vital portion of its body, and in which a wound is certain to produce death.

Hunting the Rhinoceros.

Other hunters pursue on horseback and kill the rhinoceros with extraordinary courage and address. Two men ride on the same horse. The one is dressed and armed with javelins; the other is naked, and has nothing but a long sword in his hand. The first sits on the saddle, the second rides behind him on the horse's rump. As soon as they get on the track, they start off in pursuit, taking care to keep at a great distance from the rhinoceros when it plunges into the thickets, in the midst of which it opens for itself a broad passage, which closes as the animal passes on, but the moment it arrives in an open spot they pass it, and place themselves opposite to it. The animal, in a rage, hesitates for a moment, then rushes furiously upon the horse and its riders. These avoid the assault by a quick movement to the right or the left, and the man who carries the long sword lets himself slide off on to ground without being perceived by the rhinoceros, which takes notice only of the horse. Then the courageous hunter, with one blow of his formidable weapon, cuts through the tendon of the ham or hock of one of the monster's hind legs, which causes it to fall to the ground, when it is despatched with arrows and the sword. The grandees of Abyssinia also engage in the pursuit of the rhinoceros. But they attack these animals with guns. It is in this way also that the Hottentots and the colonists of the Cape of Good Hope hunt this pachyderm.

A Horse and Rider Tossed in the Air.

Little inferior to the elephant in strength, though by no means approaching it in sagacity, the different species of rhinoceros manifest an irascibility against man which waits not for provocation; or rather the sight of a man is itself a sufficient provocation to excite a paroxysm of restless fury. One traveller mentions a Hottentot who had acquired a reputation as a bold elephant-hunter, who on one occasion had his horse killed under him by a rhinoceros. Before he could raise his gun, the

enormous beast rushed upon him, thrust its sharp-pointed horn into the horse's chest, and threw him bodily, rider and all, over its back. The



TERRIBLE ENCOUNTER WITH A RHINOCEROS.

savage animal then, as if satisfied, went off, without following up its victory, and before the Hottentot could recover himself sufficiently for an avenging shot.

One of Livingstone's men met with a similar adventure. He was once stalking two of these beasts, and as they came slowly to him, he knowing that there is but little chance of hitting the small brain of this animal by a shot in the head, lay, expecting one of them to turn his shoulder, till he was within a few yards. The hunter then thought that by making a rush to his side he might succeed in escaping; but the rhinoceros, too quick for that, turned upon him, and though he discharged his gun close to the animal's head he was tossed in the air. My friend, adds Doctor Livingstone, who gives the account, was insensible for some time, and on recovering found large wounds on the thigh and body. I saw the one on the former part, still open, and five inches long. The white species, though less savage than the black, is not always quite safe, for one, even after it was mortally wounded, attacked a horse, and thrust the horn through to the saddle, tossing at the same time both horse and rider.

The Bone-Plated Crocodile.

One species of the crocodile must be classed among the veritable curiosities of the animal creation. It has not the size of its great antediluvian ancestor, a full description of which has already been presented to the reader, but in its native clime it has long been regarded as a creature very remarkable in construction and habits.

The crocodile was considered a sacred animal by the ancient Egyptians. In ruins of temples mummies of crocodiles are still found in a perfect state of preservation. The Romans introduced living crocodiles at the national games in the Colosseum. At first only five were imported, but under the Emperor Augustus thirty-six were killed in the circus of Flaminius. Several ancient medals represent this reptile, the body of which perfectly resembles those now found in the Nile. There is a truly wonderful fact in the natural history of the crocodile. Listen to what Herodotus, the father of history, tells us with regard to it: When the crocodile takes its food in the Nile, the interior of its mouth is always covered with flies. All birds, with one single exception, flee from the crocodile; but this one, the Nile bird, far from avoiding it, flies towards the reptile with the greatest eagerness, and renders it a very essential service. Every time the crocodile goes on shore to sleep, and at the moment when it lies extended with open jaws, the Nile bird enters the mouth of the terrible animal and delivers it from the insects which it finds there; the crocodile shows its recognition of the service by never harming the bird. This fact, reported by Herodotus, was long considered to be a fable, but a naturalist, who formed part of the commission that Bona-

parte took with him into Egypt, had on several occasions opportunities of proving the truth of the historian's narrative.

In a memoir read to the Academy of Sciences he says it is perfectly true that there exists a little bird which flies about, perpetually seeking, even in the mouth of the crocodile, the insects which form the principal part of its nourishment. This bird is like a plover. The fly, which thus torments the crocodiles and even excites them to madness, is no other than our common gnat. Myriads of these insects haunt the banks of the Nile, and when these giants of its waters repose on its margin to warm themselves in the sun, they become the prey of these insignificant pigmies. It is like the war between the lion and the mouse, described by La Fontaine. Crocodiles are more voracious than alligators. Hasselquist asserts that in Upper Egypt they often devour women, who come to draw water, or children playing upon the banks of the Nile. Geoffroy Saint Hilaire says, that in Thebaid Napoleon's army often met with Arabs mutilated by the crocodiles. Sir Samuel Baker also mentions, in his late work on the "Nile and its Tributaries," the craving of these amphibia for human flesh, and the dread they are held in by the natives.

A Monster Devouring Children.

Livingstone gives the following account of these ferocious animals: The crocodile, says the famous traveller, makes many victims every year among the children who are so imprudent as to play on the banks of the Liambia when their mothers go to fetch water. The crocodile stupifies its victim with a blow from its tail, then drags it into the river, where it is soon drowned. In general, when the crocodile perceives a man it dives, and furtively glides away from the side which he occupies. Sometimes, on the other hand, it precipitates itself with surprising agility towards the person it has discovered, which may be noticed from the disturbance caused on the surface of the water. An antelope which is being hunted and takes to the water, in the lagunes of the Barotsé valley, a man or a dog who goes there to seek for game, will scarcely fail to be seized by a crocodile, of whose presence he has not the slightest suspicion. It often happens that, after having danced in the moonlight, the young natives will plunge into the water, in order to refresh themselves, when, being seized by an alligator, they perish.

This mode of attack (striking with the tail) is also one of the methods adopted by the alligator of America for disabling its prey. A sportsman whose veracity is undoubted, while shooting wild fowl on one of the tributaries of the Lower Mississippi, had the fortune to witness a fight

between a bear and an alligator. He was called to the scene of the struggle by the noise made by the combatants in the dry cane, that yielded to their pressure as they fought in each other's embrace. Several times both ceased, only to recover breath and fresh energy; at length the alligator missed striking the foe with its tail, Bruin seized the opportunity, and with all his efforts succeeded in turning the amphibian on its back, where he held him for some minutes, at the same time gnawing one of its fore-shoulders. A final struggle of the now-worsted alligator hurled both into the water, where they disappeared, the disturbed surface telling of the dreadful contest that was being prolonged beneath; after the lapse of over a minute the bear came up, evidently much fatigued, and swam ashore, the sportsman forbearing to wound, or possibly kill, the gallant conqueror.

Crocodiles, it is said which have never eaten human flesh, are much less dangerous than those that have acquired a taste for it. Mr. Combes, of "Chinese" Gordon's expedition, states that he was assured by an inhabitant of Khartoum, who had reached the town with the Egyptian troops—that is to say, before the horrors committed by the Desterdar, acting with Mehemet Bey, who had been Governor of the Soudan—that the crocodiles appeared to be quite indifferent to human flesh; but after the many executions by drowning ordered by Mehemet Bey, as he was told by a native whom he interrogated—"since the Nile has been loaded with the carcasses of my brethren, the monsters which inhabit it have become habituated to substantial food, which they scarcely knew before, so that afterwards those swimming in the river, or even bathing on its banks, were exposed to imminent danger."

Stabbed Under Water With a Dagger.

Natives of Africa shoot the crocodile, or attack it with a barbed javelin, which is thrown by hand, and aimed at the fore-shoulder. Some Egyptians are reported to be daring enough to swim under the crocodile, and pierce him in the belly with a dagger. The negroes of Senegal are said to be equally expert. If they surprise the animals in parts of the river where there is not sufficient water for them to swim, they attack the monster with a lance, commencing the assault by aiming with their weapon at their enemy's eyes and throat; then thrusting their arm, encased in leather, into its mouth, they hold it open till their enemy is either suffocated or expires under its wounds. Traps are also employed successfully for their destruction. In Egypt the natives dig a deep hole in the ordinary route of the crocodile, which is easily discovered by the trail they leave in the sand—this is covered with branches and earth,

which falls in when trodden upon; the captive is then killed, often with the most brutal cruelty. At other times a thick cord is attached to a tree, at the other end of which a lamb is held by a hook. The cries of the lamb attract the crocodile, which, in its attempt to carry off the bait, is taken.



THE CURIOUS GAVIAL OF INDIA.

Still another method for the destruction of these repulsive-looking creatures has been adopted by Englishmen in India. A dead animal is procured, in its abdomen is placed a loaded shell, to which is attached a

wire made fast to an electric battery; when the bait has been seized and carried to the bottom, the shell is exploded, and invariably maims or kills the crocodile.

The gavials have long narrow cylindrical muzzles, slightly inflated at the extremity; the teeth are almost the same, both in number and shape, on each jaw; the two first and the fourth of the lower jaw pass into notches or indentations in the upper jaw. The gavials are chiefly remarkable for their long head, its type being the gavials of the Ganges. It is of a deep watery green color, having on the upper part numerous irregular brown spots; in the young, the back and limbs are transversely banded with black; the lower part is of a pale whitish yellow; the jaws are marked with brown, the claws are of a clear horn color. This species is not so carnivorous as the others, and is consequently less dreaded. The gaval of the Ganges is supposed to be the largest of the existing saurians; its length, as given by one traveller, is seventeen feet four inches, although in reality this length is often exceeded.

The gaval of the Ganges has the jaws produced to an enormous length, forming a long, slender snout, at the extremity of which there is a large cartilaginous protuberance, in which the nostrils are situated. The teeth are very numerous, and nearly equal in size throughout the whole of the jaws. It is web-footed to the extremities of the toes of the hind feet. This species is found abundantly in the fresh waters of India, where it sometimes attains a length of thirty feet. It is not dangerous to man nor the larger quadrupeds. It was known to the ancients, Ælian mentioning the existence of a crocodile in the Ganges which had a horn at the extremity of its nose. Though there are several marked varieties, there appears to be but one species.

The Flying Dragon.

At the present day we have no examples of reptiles which can really fly, though we have some which, like the flying squirrels, are able to sweep for some distance through the air. These animals are known by the popular name of the flying dragon, in consequence of their resemblance to the conventional dragon of fables. There are several species of them, all agreeing in form and general habits. The tail is very long, very slender, and tapers to a sharp point.

The structure by which these reptiles are enabled to pass through the air is very remarkable. As the reader may see by the engraving, the sides of the body are expanded like those of the flying squirrels, but the expansion is obtained in a different manner. In the flying squirrel, the skin of the sides is expanded with the membrane, which is opened by

stretching out the legs; but in the flying dragon the ribs are employed for the purpose.

The reader will distinguish the difference between the two kinds of ribs. There are the "true" ribs, which occupy the upper part of the chest, and which have their ends resting on the breast-bone; and the "false" ribs, which occupy the lower part of the chest, and which have their ends free. It is by means of the latter set of ribs that the expansion of the sides is managed.

The false ribs, instead of being, as they usually are, much shorter than



FLYING DRAGON AND FLYING FROG.

the others, are generally lengthened, or, to be more accurate, they are furnished with very long and slender appendages. These additional bones are so joined to the ribs that they can be spread out laterally, or laid against the sides at the pleasure of the animal. When they are spread, they very much resemble the sticks of an opened fan, and as they are connected with each other by a membrane which is formed from the skin of the sides, they offer a very wide surface to the air.

The movements of the flying dragon are curiously like those of the flying squirrels of our own country, and the flying marsupials of Australasia; and indeed, if the flying dragon and the opossum mouse were

simultaneously to spring from one tree to another, their sweeping flight would have been almost identical, and it would not be easy to distinguish between the two animals.

There is another point in the structure of the flying dragon which has been thought to have some effect in increasing its buoyancy when in the air. In common with many arboreal lizards, it possesses a large pouch under the throat, which it is capable of inflating to a very great extent. When the lizard is preparing to launch itself into the air, it inflates this sac simultaneously with spreading its wings, if we may use this term to express its peculiarly constructed side. Many naturalists have thought that the principal object of this sac is to increase the buoyancy of the animal while in the air. It does probably have that effect, but buoyancy is not its chief object, for the reason that the inflatable pouch is found in many lizards which do not possess the expansible sides, nor the power of skimming through the air. The flying dragons are tolerably plentiful in Borneo, Java, and the Philippine Islands.

The Flying Frog.

Many readers must be familiar with the pretty tree frogs, which are now so plentiful in ferneries. Their habits are curiously contrary to those of the ordinary frogs, for they abandon both earth and water for the trees, and lead an arboreal, and not a terrestrial or aquatic life as do their fellows. In order to enable them to ascend trees, they are furnished with sucker-like appendages at the tips of their toes, and with these they can cling firmly to any smooth object, such as the trunk of a tree, the surface of a leaf or even a flat piece of glass.

In the last-mentioned case, it is interesting to examine with a magnifying lens the structure of the suckers as they are pressed against the glass, and to note how instantaneous is their action of exhausting or admitting the air at will. This structure, indeed, is absolutely necessary for the creature's existence. It lives upon insects, and if it were to depend for its subsistence upon those which come within its reach, it would stand a good chance of starving. But, aided by these marvelous developments of the feet, it is able to spring at a passing insect, to catch it, and to affix itself instantaneously to another branch. There are many species of tree frogs, spread over a large portion of the earth, but the most remarkable at present known is the flying frog of Borneo.

If the reader will refer to the accompanying illustration, he will see the flying frog shown in the act of passing through the air, its toes being widely spread, so as to stretch the membrane which connects them. In proportion to the size of the reptile, the extent of surface which can be

thus opposed to the air is very great. The body of the frog is about four inches in length, while the web of each hind foot covers a space of four square inches, and if the webs of all four feet be put together, they will be seen to equal a space of twelve square inches. It is evident enough, therefore, that a creature which is only four inches in length, and which is able to spread a flat membrane of twelve square inches, would be upborne for some distance through the air, if it only projected itself with some force.

Wings and Feet Combined.

Except that the limbs do not seem to be moved when the frog passes through the air, there is but little difference between the structure of the bat's wing and the membrane of the flying frog, each being nothing but an existing membrane developed and expanded by being attached to the lengthened toes. In order, also, to assist in the buoyancy of the creature, the body is capable of considerable inflation. In life it is a very handsome species. The back is a rich deep green, and the under surface yellow. The webs are black, adorned with streaks of yellow.

Probably these enormously developed feet are used for swimming as well as for flight, and in that case they will form a remarkable analogy with the wings of the extinct pterodactyls, which are proved with tolerable certainty to be organs adapted to the water as well as to the air.

The body of the edible frog, sometimes attains a length, from the extremity of the muzzle to the end of the hind feet, of six to eight inches. The muzzle terminates in a point; the eyes are large, brilliant, and surrounded with a circle of gold color. The mouth is large; the body, which is contracted behind, presents a tubercular and rugged back. It is of a more or less decided green color on the upper, and whitish on the under parts. These two colors, which harmonize well, are relieved by three yellow lines, which extend the whole length of the back, and by scattered black marblings. It is, therefore, much to be regretted that prejudice should cause some at least of us to dislike this pretty little creature.

CHAPTER VIII.

WILD ANIMALS OF THE FOREST AND JUNGLE.

Old Classic Tales Concerning the Lion—His Majesty Once a Native of Europe—Leaping the Hedge Into the Trap—Captured by Stratagem—Boundaries of the Lion's Kingdom—A Human Head in a Lion's Mouth—A Roar Like the Sound of an Earthquake—Alarm of the Inhabitants of Plain and Forest—Massive Muscles and Immense Shoulders—A Singular Encounter—Shocking Scene—A Heart-Rending Cry for Help—Brute Affection—The Sailor and Baboon—Livingstone's Adventure With a Lion—The Royal Tiger—Tamed for a Pet—Dreadful Ferocity—A Guide Killed by a Blow—Exciting Episodes in Tiger Hunting—Carrying Off a Buffalo—Savage Courts Entertained by Brutal Sport—Elephants Hunting the Tiger—The American Black Bear—The Labiated Bear—The Bear's Song—Ludicrous Antics—The Celebrated "Martin."—The Gigantic Hippopotamus—Description of the Animal—Arrival of a River-Horse in Europe—Strange Actions and Crowds of Curious Spectators.



THE true lions belong exclusively to the Old World, and they were formerly plentifully and widely diffused, but confined at present to Africa and Asia, they are daily becoming more scarce in those parts of the earth. There can be no doubt that lions were once found in Europe. Herodotus records that the baggage camels of the army of Xerxes were attacked by lions, the other beasts and the men remaining untouched. Pausanias tells the same tale, and also states that lions often descended into the plains at the foot of Olympus, which separates Macedonia from Thessaly; and that a celebrated athlete slew one of them, though he was unarmed. Pliny affirms that the lions of Europe were stronger than those of Africa and Syria. Lions have disappeared from other parts of the world, as Egypt, Palestine, and Syria where they once were evidently far from uncommon.

Ezekiel speaks of a lion—an animal with which his people must have been acquainted: "Then the nations set against him on every side from the provinces, and spread their net over him; he was taken in their pit." Thus, there is an allusion to the practice of the Arabians and of other people. They dug a large circular pit, and at night introduced into it a goat, which they bound to a stake or pillar of earth at the bottom, and then so inclosed the pit with a hedge of branches, that it could not be seen, leaving no entrance. The lion, hearing in the night the voice of the goat, prowled around the hedge, and, finding no opening, leaped over, and was taken.

When the hunter proposed to catch him in his toils, he stretched a series of nets in a semicircular form, by means of long poles fixed in the ground; three men were placed in ambush, among the nets, one in the middle, and one at each extremity. The toils being disposed in this manner, some waved flaming torches, others made a noise by beating their shields, thinking that lions were not less terrified by loud sounds than by fire. The men on foot and horseback, skilfully combining their movements, and raising a great bustle and clamor, rushed in upon them, and drove them towards the nets, till, intimidated by the shouts of the hunters and the glare of torches, they approached the snares of their own accord, and became entangled in the folds.

In the sandy deserts of Arabia, in some of the wild districts of Persia, and in the vast jungles of India, the lion still maintains a precarious footing; but from the classic soil of Greece, as well as from the whole of Asia Minor, both of which were once exposed to his ravages, he has been utterly dislodged and extirpated. In the vast and untrodden solitudes of Africa, from the immense deserts of the north to the trackless forests of the south, he reigns supreme and uncontrolled. From the Cape of Good Hope, however, he is annually retiring farther and farther before the persecution of man.

An Enormous Mouth.

The opening of the lion's mouth is of great extent in proportion to the size of the animal. In travelling menageries it has long been the custom, "more honored in the breach than the observance," however, for a keeper to thrust his head into a lion's mouth—a practical proof of its capacity—to the no small amusement of some, and the equal terror of others, among the gaping spectators. The muscles which move the lower jaw are also of great bulk, and the point on which they immediately act is brought so far forwards, in consequence of the breadth and shortness of the muzzle, as to give them the highest degree of attainable force.

There is yet one peculiar distinction of the lion, as well as of all animals of the same family, which deserves particular attention. The most obtuse of their senses is that of taste. According to Desmoulins, the lingual nerve of the lion is not larger than that of a middle-sized dog. The tongue of all animals of the cat kind is an organ of mastication, as well as of taste. Whatever flesh a lion's teeth may leave on a bone is scraped away by the sharp and horny points, inclining backwards, of his tongue.

The roar of a lion sometimes resembles the sound which is heard at

the moment of an earthquake; and is produced by laying his head on the ground, and uttering a half-stifled growl, by which means the sound is conveyed along the earth. The instant it is heard by the animals reposing in the plains, they start up in alarm, fly in all directions, and even rush into the danger they wish to avoid. This fearful sound is produced by the great comparative size of the larynx—the part of the throat that forms the upper part of the windpipe.

Terrible Roar of the Forest King.

The roaring of the lion has always been a proverb. When heard within a distance of a mile or two during the silence of the night, it awes all living creatures. When this great voice echoes over the plain the cattle tremble in the farms, and follow with anxiety its various modulations, in order to inform themselves of the direction in which the enemy is approaching. If the lion comes to prowl around the inclosure in which they are sheltered they exhibit symptoms of the most intense fear. Their sense of smell alone suffices to indicate, even at a considerable distance, the dreaded presence.

It is in spring that the lion seeks a mate, and when an alliance is formed they show themselves most devoted to one another. Until the female has young, the lioness follows her lord everywhere, and most frequently the male is charged with providing the common subsistence. It is said that he pushes his gallantry so far as to refuse to eat first, and that he does not approach the prey captured by himself until the lioness is satisfied; and, on the other hand, the latter defends him with energetic fury if he be attacked.

The immense masses of muscle around the lion's jaws, shoulders, and fore arms, says Livingstone, proclaim tremendous force. They would seem, however, to be inferior in power to those of the Indian tiger. Most of these prodigious feats of strength, that I have seen performed by lions—such as the taking away of an ox—were not carrying, but dragging, or trailing the carcass along the ground. They have sprung, on some occasions, on to the hind quarters of a horse. They do not mount on the withers of an eland, but try to tear him down with their claws.

A Ferocious Struggle.

Livingstone gives a singular encounter, as described to him in a letter from Mr. Frank Vardon; Oswell and I were riding along the banks of the Leinpopo, when a water-buck started in front of us. I dismounted, and was following it through the jungle, when three buffaloes got up, and, after going a little distance, stood still, and the nearest bull turned round and looked at me. A ball from the two-ouncer crashed into his shoulder

and they all three made off. Oswell and I followed as soon as I had re-loaded, and when we were in sight of the buffalo, and gaining on him at every stride, three lions leaped on the unfortunate brute; he bellowed most lustily as he kept up a kind of running fight; but he was, of course, soon overpowered and pulled down.

We had a fine view of the struggle, and saw the lions on their hind legs tearing away with teeth and claws in most ferocious style. We crept up within thirty yards, and, kneeling down, blazed away at the lions. My rifle was a single barrel, and I had no spare gun. One lion fell dead almost on the buffalo; he had merely time to turn towards us, seize a bush with his teeth, and drop dead with the stick in his jaws. The second made off immediately; and the third raised his head, coolly looked round for a moment, then went on tearing and biting at the carcass as hard as ever. We retired a short distance to load, then again advanced and fired. The lion made off, but a ball that he received ought to have stopped him, as it went clear through his shoulder-blade. He was followed up and killed, after having charged several times. Both lions were males. It is not often that one bags a brace of lions and a bull buffalo in about ten minutes. It was an exciting adventure, and I shall never forget it. Such, my dear Livingstone, is the plain, unvarnished account. The buffalo had, of course, gone close to where the lions were lying down, and they, thought the opportunity too good a one to be lost.

Safety only in Distance.

When encountered in the daytime, says Livingstone, the lion stands a second or two gazing, then turns slowly round, and walks as slowly away for a dozen paces, looking over his shoulder; then begins to trot, and, when he thinks himself out of sight, bounds off like a greyhound. By day there is not, as a rule, the smallest danger of lions, which are not molested, attacking man, nor even on a clear, moonlight night, except when they have young; this makes them brave almost any danger; and if a man happens to cross to the windward of them, both lion and lioness will rush at him. This does not often happen, as I became aware of two or three instances of it. In one case a man, passing when the wind blew from him to the animals, was bitten before he could climb a tree; and, occasionally, a man on horseback has been caught by the leg under the same circumstances. So general, however, is the sense of security on moonlight nights, that we seldom tied up our oxen, but let them lie loose by the wagons; while on a dark, rainy night, if a lion is in the neighborhood, he is almost sure to venture to kill an ox. His approach is always stealthy, except when wounded; and any appearance of a trap is enough

to cause him to refrain from making the last spring. This seems characteristic of the feline species.

When a lion is hungry, he will do what he would not under other circumstances. Thus, one had been near a Bushman's hut the whole night, doubtless on the look-out for prey. Two Bechuana herdsmen, attending the cattle near the place next morning, saw him, and ran towards a neighboring kraal, or village, to inform the people. On their way thither they met six natives coming to attack the formidable creature, having already heard he was there. Advancing, they fired and wounded, but did not disable him. Enraged by the smart, he took some steps, when the natives instantly leaped from their horses, formed them into a close line, with their tails towards the lion, and took their stand at the horses' heads.

The lion now flew on a Bechuana, who was not protected by the intervention of the horses, and who tried to defend himself with his sheep-skin cloak. The lion, however, caught him by the arm, threw him on the ground, and, while the poor man still tried to defend himself, by keeping his cloak wrapped round him, the lion got under it and gnawed part of his thigh. His Bechuana companion at that time threw his spear, which penetrated the man's cloak, and entered the lion's back. The same man threw another spear, but, instead of taking the direction he intended, it pierced the body of a dog that was barking near. The natives would have fired, but they were afraid of shooting the man. To drive him away, however, if possible, they made a great noise, and threw some stones. The lion then left the man and rushed toward them, when they again checked his attack by turning the horses round. He next crept under the belly of a mare, and seized her by the fore legs, but, with a powerful kick, she made him let go his hold. In revenge, and by one stroke of his paw, he tore open the body of the mare, and retired. After this, he tried to get round the horses to the men; but when within two yards of one of them, and on the point of making a spring, he was happily killed by a musket shot, the ball penetrating behind the ear.

A Terrible Scene.

Mr. Gordon Cumming, who has earned for himself a rather unenviable reputation by his ruthless slaughter of animals, graphically describes a terrific scene: All had retired to rest, when suddenly the appalling and murderous voice of an angry, bloodthirsty lion burst upon my ears within a few yards of us, followed by the shrieking of the Hottentots. Again and again the murderous roar of attack was repeated. We heard John and Ruyter shriek, "The lion! the lion!" Still, for a few moments, we

thought he was but chasing one of the dogs round the kraal, but the next instant John Strofulus rushed into the midst of us, almost speech-



THE IMPERIAL LION OF AFRICA.

less with fear and terror, his eyes bursting from their sockets, and shrieked out, "The lion! the lion! he has got Hendrick! he dragged him away from the fire beside me. I struck him with the burning brands on his head,

but he wouldn't let go his hold. Hendrick is dead! O God! Hendrick is dead! let us take fire and seek him!"

The rest of my people rushed about shrieking and yelling as if they were mad. I was at once angry with them for their folly, and told them that if they did not stand still and keep quiet, the lion would have another of us, and that very likely there was a troop of them. I ordered the dogs, which were nearly all fast, to be made loose, and the fire increased as far as could be. I then shouted Hendrick's name, but all was still. I told my men that Hendrick was dead, and that a regiment of soldiers could not now help him; and hunting my dogs forward, I had everything brought within my cattle kraal, when we lighted our fire, and closed the entrance as well as we could.

In the Jaws of Death.

It appeared that when the unfortunate Hendrick rose to drive in the ox, the lion had watched him to his fireside, and he had scarcely lain down when the brute sprang upon him and Ruyter (for both lay under one blanket), with his appalling, murderous roar; and, roaring as he lay, grappled him with his fearful claws, and kept biting him on the breast and shoulders, all the while feeling for his neck; having got hold of which, he at once dragged him away backwards, round the bush into the dense shade. As the lion lay on the unfortunate man, he faintly cried, "Help me! help me! O God, men, help me!" After which the fearful beast got hold of his neck, and then all was still, except that his comrades heard the bones cracking between the teeth of the lion.

The Bushmen have remarked that the lion generally kills and devours his prey in the morning at sunrise, or at sunset; when, therefore, they intend to kill these animals, they notice where the spring-bucks are grazing at the rising of the sun, and by observing, at the same time, if they appear frightened and run off, they conclude that they have been attacked by the lion. Marking accurately the spot where the alarm took place, about eleven o'clock in the day, when the sun is powerful, and the enemy they seek is supposed to be fast asleep, they carefully examine the ground, and, finding him in a state of unguarded security, they lodge a poisoned arrow in his breast. The moment the lion is thus struck, he springs from his lair and bounds off as helpless as the stricken deer. The work is done; the arrow of death has pierced his heart without even breaking the slumbers of the lioness which may have been lying beside him; and the Bushman knows where, in the course of a few hours, or even less time, he will find him in his last agonies, or actually dead.

Sir George Davis, who was English consul at Naples, when a great plague raged there, retired in consequence to Florence. Visiting, one day, the menagerie of the Grand Duke, he noticed a lion at the further end of one of the dens, which the keepers stated they had been unable to tame, though every effort had been made for upwards of three years. Yet no sooner had Sir George reached the gate of the den, than the lion ran to it, reared himself up, purred like a cat when pleased, and licked the hand that was put through the bars. The keeper was astonished, and, frightened for the safety of his visitor, entreated him not to trust an apparent fit of frenzy, as the lion was the most fierce and sullen of his tribe he had ever seen. This, however, had no effect on Sir George, who insisted on entering the lion's den. The moment he got in the lion manifested the greatest delight, threw his paws on his shoulders, licked his face, ran about him, and purred like an affectionate cat.

This occurrence became the talk of Florence, and reached the ear of the Grand Duke, who sent for Sir George, and requested an interview at the menagerie, that he might personally witness the conduct of the lion.

"A captain of a ship from Barbary," said Sir George, "gave me this lion when quite a whelp. I brought him up tame; but, when I thought him too large to run about the house, I built a den for him in my courtyard. From that time he was never permitted to be loose, except when brought to the house to be exhibited to my friends. When he was five years old he did some mischief by pawing and playing with people in his frolicsome moods. Having gripped a man one day a little too hard, I ordered him to be shot, for fear of incurring any guilt. On this, a friend begged him as a present. How he came here I know not."

"Your friend, Sir George," said the Grand Duke, "was the very same person who presented this lion to me."

Device of a Lioness to Save Her Young.

The following well authenticated fact helps to reveal the nature of this wonderful animal. Part of a ship's crew being sent on shore, on the coast of India, for the purpose of cutting wood, one man, induced by curiosity to stray to a considerable distance from his companions, became greatly alarmed as he saw a large lioness walking towards him. On her coming up, however, his fear was allayed; she laid down at his feet, looking very earnestly first in his face, and then at a tree a little way off, and afterwards proceeded to the tree, yet looking back, as if she wished the sailor to follow her. At length he ventured, and approaching the tree he saw a huge baboon, with two cubs in his arms, which he immediately supposed to be those of the lioness, as she couched down like a cat, and

LIVINGSTONE'S NARROW ESCAPE,



eyed them intently. Afraid to ascend the tree, the man decided on cutting it down; provided with his axe, he set earnestly to work, the lioness watching apparently every movement; as soon as the tree fell she tore the baboon in pieces, and then turned round and licked her cubs. She now returned to the sailor, rubbed her head fondly against him, and then carried away her cubs one by one.

A Savage Attack Upon Livingstone.

The villagers of Mabotoa, among whom was Livingstone, were much troubled by lions, which leaped into their cattle-pens and destroyed their cows. To such an extent did the lions carry their depredations that the natives announced their belief that they were bewitched—"given into the power of the lions by a neighboring tribe"—and sought Livingstone's advice on the subject. Well knowing that if one troop of lions is killed the others frequently take the hint and leave that part of the country, he gave the villagers advice to that end, and, in order to encourage them, offered to lead the hunt. The lions were found on a hill covered with trees, and about a quarter of a mile in length. The men circled the hill, and gradually edged in closer and closer, so that the game might be completely surrounded. Presently the native who accompanied Livingstone spied a lion sitting on a piece of rock and fired at him, the ball missing the beast and striking the rock on which the animal was sitting. The animal turned, bit like a dog at the spot where the bullet had struck, and then bounded off to the shelter of the brushwood.

Presently Livingstone spied another lion in much the same situation as the former, and being not more than thirty yards distant from it, let fly both barrels. The villagers frantic with joy, were for rushing in on their enemy at once, but Livingstone who through the bushes could see his game still on its legs, with its eyes glaring and its tail bolt upright, checked their impetuosity, and requested them to wait until he again loaded his gun; but while in the act of ramming home his bullets the natives set up a sudden and frightful cry, and raising his head, there was the wounded lion fairly springing at him.

Livingstone was standing on a slight eminence, and in his great leap the maddened beast caught the missionary by the shoulder, and lion and man rolled to the ground together. And now comes a curious fact—the better worth noting, because from its dangerous nature the experiment is rather unlikely to be tried even by the most enthusiastic zoologist. Growling horribly in my ear, says Livingstone, he shook me as a terrier does a rat. The shock produced stupor, similar to that which seems to be felt by a mouse after the first shake of the cat. It caused a sort of

dreaminess, in which there was no sense of pain or feeling of terror, though quite conscious of all that was happening. It was like what patients partially under the influence of chloroform describe, who see all the operations but feel not the knife. This singular condition was not the result of any mental process. The shake annihilated fear, and allowed no sense of horror in looking around at the beast.

The great fore-paw of the lion was pressing heavily on the back of Livingstone's head, and he almost insensibly turned to relieve himself of the pressure, and at that very instant the animal leaped from his prostrate victim to attack one of the natives who had offered to shoot at him, but his piece missed fire. This man he bit in the thigh, and left him to spring at the neck of a second native, who, armed with a spear had come to the rescue. The exertion, however, was too much for the mortally-wounded beast, and so, with his claws bedded in the spearman's shoulder he rolled over and died.

The Asiatic Tiger.

Nearly equal to the lion in strength, and, perhaps, surpassing him in activity, the tiger has generally been placed second in this tribe of animals. Its general form and appearance are so well known, that a few words of description will suffice. The tiger has no trace of the shaggy mane which adds so greatly to the bold-looking front of the lion; and his countenance, scowling under the different passions, conveys the idea of wanton treachery and cruelty. In shape he is more slender and lengthened than the lion; the head is rounder, the whole form is more cat-like, and all his motions are performed with apparent ease and greatest grace.

The tiger is exclusively an Asiatic animal, and his range extends not only over the more southern part of the continent, but to the larger islands of the Archipelago, where he is particularly destructive. He is as tall as the lion, but not quite so powerful; he is, however, more agile, more graceful, and more insidious. He crouches, and mostly springs in the same manner as the lion and other feline animals; he is more ferocious, and will even fight with the lion. He seems to delight in blood itself, for he will kill several victims, suck their blood, and leave their carcasses to be devoured at another opportunity.

The color of the tiger is a bright orange tawny, white underneath, and broad black stripes on the back, sides, and tail. In seeking his prey he takes the most enormous leaps; he can be tamed to a certain extent, but is never to be trusted. He prowls both night and day; and in some places, the devastation he has caused is terrific. Nothing can exceed

the tragic tales that are told of him, in the countries where he exists in numbers; and in one part of India, it is said that at least three hundred lives are taken every year, within a district containing seven villages, independent of an enormous number of sheep, goats, and cattle.

How the Elephant Deals With the Tiger.

Horses will not stand in his presence with any steadiness; and the elephant is restless when in his vicinity. This sagacious animal often manages to shake him off; and if he takes hold of his trunk, he tramples on him with his fore-feet and so destroys him. If he cannot dislodge him from his body, he lies down upon him, and attempts to kill him by rolling his ponderous weight upon him. Seldom, however, is the tiger the aggressor, unless he be driven to it by hunger, or maddened by pain and despair, and then he struggles till he dies. He hides himself with such caution and skill that travellers are laid hold of without being aware of his nearness.

The history of an unfortunate guide is an instance of the immediate mischief which ensues from the first blow of one of these powerful creatures. The man remonstrated with the officer, whose party he was conducting, on the imprudence of marching before daylight; but the officer, supposing it to be laziness, threatened to punish him if he did not go. The man took his shield and sword, and walked along the narrow path, bordered on each side by high grass and bamboo. After going five miles, the officer heard a tremendous roar, and a large tiger passed him, so close, that he nearly brushed his horse, and sprang upon the guide. The latter lifted up his shield, but he was down in an instant, and under the tiger's paws, which seized him with his teeth, growled, and looked at the officer. The tiger was attacked, and so severely wounded that he dropped his victim; but it was all over with the poor guide, the first blow having literally smashed his head in pieces.

A Deadly Blow.

In a plain near the Narbudda river, a party were hunting a tiger; but the beast did not seem inclined to come to a battle with his antagonists. He trotted across the plain, and as he passed an unfortunate cow, he raised his paw, gave her a blow on the shoulder, and she fell. He went on, and when the hunters examined the cow, she was dead, he having left the print of every toe, and, in fact, every part of his paw upon the shoulder blade, without making the smallest wound.

A tiger had sprung upon the shoulder of an English officer, Lieutenant Colnett's elephant, who in this situation fired at him, and he fell. Conceiving him to be disabled, the Lieutenant descended from the elephant

for the purpose of despatching him with his pistols; but in alighting he came in contact with the tiger, which had only crouched for a second



THE ROYAL TIGER OF INDIA.

spring, and which, catching hold of him by the thigh, dragged him some distance along the ground. Having succeeded in drawing one of a brace

of pistols from his belt, Lieutenant Colnett fired, and lodged a ball in the body of the tiger, when the beast became enraged, shook him violently, without letting go his hold, and made off towards the thickest part of the jungle with his prey. In the struggle to disengage himself from the clutches of the animal, the Lieutenant caught hold of the tiger by both his ears, and succeeded, after some time, in throwing the beast on his side, when he availed himself of his momentary release to draw forth the remaining pistol, and placing the muzzle at the breast of the tiger, shot him through the heart. He then returned to his elephant, which he mounted without assistance, feeling at the moment little pain from his wounds, although he received no fewer than thirty-five, from the effects of which he long afterwards continued to suffer.

Wild Fury of a Tigress.

The people of Chittagong were alarmed by the appearance of a tigress, which was first discovered among some cattle that were grazing at the mouth* of the river. On the first alarm, the natives of the vicinity assembled with all speed and advanced against her. Irritated by this she sprang furiously upon the person nearest to her, and wounded him severely. The immediate attack of the crowd, however, was successful in rescuing the man from her grasp. On this the tigress, finding herself hemmed in on all sides, and seeing no way of avoiding the multitude, except by the river, took to the water, and swam about five miles closely pursued by the natives in their boats, until she landed under a tree in a dockyard. Here she laid herself down, apparently much fatigued; but before the people in the yard could get their fire-arms ready, she had, in a great degree, recovered her strength. Several shots were fired at her, and two of them penetrated her body, one of which lamed her.

Rendered desperate by this, she advanced against her new opponents, and singling out a European gentleman in the yard, who was provided with a cutlass, she sprang upon him before he could make use of his weapon; knocked him down with her fore paw, seized his head in her mouth, bit off a considerable part of the skin of his forehead, and wounded him in several places. After this, she sprang upon a native, fractured his skull, and otherwise lacerated him so dreadfully that he died next day. She then entered a thicket close by, where she was allowed to remain unmolested. On the morning of the following day she had got about a mile further from the water side, and near to a Sepoy village. Here she was surrounded by about a thousand natives, when, although she was very lame, she sprang furiously on several of them, and wounded one poor

woman so dreadfully, as to occasion her death. A fortunate shot, however, laid the animal prostrate.

There is an account of a tame tiger which was brought from China in an East Indiaman, which was so far domesticated as to admit of every kind of familiarity from the people on board. He seemed to be quite harmless and as playful as a kitten. He frequently slept with the sailors in their hammocks, and would suffer two or three of them to repose their heads upon his back, as upon a pillow, while he lay stretched upon the deck. In return for this, he would now and then steal their meat. Having one day carried off a piece of beef from the carpenter, the man followed the animal, took it out of his mouth, and beat him severely for the theft, which punishment he suffered with all the patience of a dog. He would frequently run upon the bow-sprit, climb about like a cat, and perform a number of tricks with astonishing agility. There was a dog on board with whom he often played in the most amusing manner; he was only a month or six weeks old when taken on board.

The Giant of the Jungle.

A buffalo, belonging to a peasant in India, having fallen into a quagmire, the man was himself unable to extricate it, and went to call the assistance of his neighbors. Meanwhile, a large tiger coming to the spot, seized upon the buffalo, and dragged him out. When the men came to the place, they saw the tiger with the buffalo thrown over his shoulder, in the act of retiring with him towards the jungle. No sooner, however, did he observe the men, than he let fall the dead animal, and precipitately escaped. On coming up, they found the buffalo quite dead, and his whole blood sucked out. Some notion may be gained of the immense power of the tiger when it is remembered that the ordinary weight of a buffalo is above a thousand pounds, and, consequently, considerably more than double its own weight.

Combats between these animals were once frequent in the island of Java, and, when they were to fight for the amusement of the court, they were brought into the field in large cages. The place was surrounded by a body of people four feet deep, with levelled pikes, that, if the creatures endeavored to break through they might be immediately killed. When all was in readiness, the cage of the buffalo was first opened at the top, and his back rubbed with the leaves of a plant, which occasioned him intolerable pain; then the animal leaped out, roaring most dreadfully. The cage of the tiger was then opened, and fire thrown into it to make the beast quit it, which he generally did, running backwards out of it. No sooner did the tiger perceive the buffalo, than he sprang upon

him; his huge opponent standing expecting him, with his horns on the ground, in order to catch him upon them, and throw him in the air. If the buffalo succeeded, and the tiger recovered from his fall, he was generally indisposed to renew the contest; and if the tiger avoided this first attempt of the buffalo, he sprang upon him, and, seizing him in the neck or other parts, tore his flesh from his bones. In most cases, however, the strength of the buffalo overcame the address and ferocity of the tiger.

Barbaric Sport.

On another occasion, a lofty bamboo palisade was erected at Siam, which occupied an area of about one hundred feet square. Into this enclosure two elephants were introduced, with their heads and trunks shielded by a kind of mask. A large tiger was now brought from its den, and held with cords till one of the elephants approached, and inflicted two or three blows on its back with his trunk, so heavily that it fell stunned as if dead. Then they loosed the tiger. No sooner did he recover than he sprang with a dreadful roar at the elephant's trunk, stretched out in the act to strike him, but the wary elephant drew up his trunk, and, receiving the tiger on his tusks, hurled him into the air. This checked the fury of the tiger—as it well might—and it gave up the contest with the elephant; but he ran several times round the palisade, frequently springing at the spectators. Afterwards three elephants were set upon him, and they, in turn, dealt him such heavy blows that he again lay senseless, and would have been killed, had not the struggle been stopped. Such a trial of strength, however, was wanton and cruel, but it placed beyond all doubt the "pluck" of the tiger.

The only animal, says a traveller in the East, found suitable to assist in the capture of the tiger is the elephant, which often displays great courage and coolness in the chase, and at times a sagacity which has saved the rider's life. On notice being given that there was a tiger in the neighborhood, the whole station was aroused, and in a state of preparation began to proceed to the cover; the elephants were brought out, and the tumult that arose before all was ready, between drivers, dogs and horses, elephants and their masters, was indescribable. From ten to thirty of these animals, each carrying a sportsman armed with rifles of various descriptions, have generally started for the jungle (though sometimes a field of nearly one hundred elephants have been out), and commenced regularly to beat for the game.

Seeking the Game.

We found immense quantities of game, wild dogs, hogs and the neilghie, literally the blue cow. We, however, strictly abstained from firing,



HUNTING A FEROCIOUS TIGER.

reserving our whole battery for the nobler game—the tiger. It was perhaps fortunate that we did not find one in the thick part of the forest, as the trees were so close set, and so interwoven with thorns and parasitic plants, that the elephants were often obliged to clear for themselves a passage by their own pressing exertions. It is curious, on these occasions, to see the enormous trees these animals will overthrow on a word from the driver; they place their foreheads against the obnoxious plant, twisting their trunks round it, and gradually bending it towards the ground, until they can place a foot upon it. This done, down comes the tree with crashing stem and upturned roots. The elephant must be well educated to accomplish this duty in a gentleman-like manner; that is, without roaring sulkily, or shaking his master by too violent exertions.

On clearing the wood, we entered an open space of marshy grass, not three feet high; a large herd of cattle were feeding there, and the herdsman was sitting singing under a bush; when, just as the former began to move before us, up sprang the very tiger to which our visit was intended, and cantered off before a bare plain, dotted with small patches of bush-jungle. He took to the open country in a style that would have more become a fox than a tiger, which is expected by his pursuers to fight and not to run; and as he was flushed on the flank of the line, only one bullet was fired at him ere he cleared the thick grass. He was unhurt, and we pursued him at full speed.

An Exciting Capture.

Twice he threw us out by stopping short in small strips of jungle, and tearing back after we had passed; and he had given us a very fast trot of about two miles, when an officer, who led the field, at last reached him by a capital shot, his elephant being in full career. As soon as he felt himself wounded, the tiger crept into a close thicket of trees and bushes, and crouched. The two leading sportsmen overran the spot where he lay; and as I came up I saw him, through an aperture, rising to attempt a charge. My driver had just before, in the heat of the chase, dropped his goad, which I had refused to allow him to recover; and the elephant being notoriously savage, and further irritated by the goading he had undergone, became, consequently, unmanageable; he appeared to see the tiger as soon as myself, and I had only time to fire one shot, when he suddenly rushed with the greatest fury into the thicket, and falling on his knees, nailed the tiger with his tusks to the ground.

Such was the violence of the shock, that my servant, who sat behind, was thrown out, and one of my guns went overboard. The struggles of my elephant to crush his still resisting foe, which had fixed one paw on

his eye, were so energetic that I was obliged to hold on with all my strength to keep myself in the seat. The second barrel, too, of the gun which I still retained in my hand, went off in the scuffle, the ball passing close to the driver's ear, whose situation, poor fellow, was anything but enviable. As soon as my elephant was prevailed upon to leave the killing part of the business to the sportsmen, they gave the roughly-used tiger the go by. It was a very fine female, with the most beautiful skin I ever saw.

The Famous Black Bear.

This animal inhabits every wooded district of the American continent, from the Atlantic to the Pacific, and from Carolina to the shores of the Arctic Sea. Man has, however, gradually driven it from its haunts to make way for his works, and has compelled it to take refuge in the mountains and the immense inland forests. In Canada it is still found, and it is tolerably numerous on the Western coast, as far as California.

The black bear is smaller than other American bears—the total length of an adult seldom exceeding five feet. Its favorite food is berries of various kinds, but, when these are not to be procured, it preys on roots, insects, fish, eggs, and such birds or quadrupeds as it can surprise. It does not eat animal food from choice; for, when it has abundance of its favorite vegetable diet, it will pass the carcass of a deer without touching it.

It is rather a timid animal, and will seldom face a man except it is wounded, or has its retreat cut off, or is urged by affection to defend its young. In such instances its strength renders it a dangerous assailant. The female has been known to confront her enemy boldly, until she had seen her cubs attain the highest branches of a tree, when she made off, evidently considering them to be in safety, but leaving them, in fact, an easy prey to the hunter. The speed of the black bear when in pursuit, is not very great, and a man may escape from it, particularly if he runs into a willow grove, or among loose grass; for the caution of the bear obliges it to stop frequently, and rise on its hind legs, for the purpose of reconnoitering. A black bear, however, has been known to make off with a speed that would have baffled the fleetest runner, and ascend a nearly perpendicular cliff, with a facility that a cat might envy.

One of the most curious of this race of animals is the labiated, or sloth bear. This animal, on its first arrival in Europe, was taken for a sloth, but Blainville proved that it is a species of bear. It is a favorite with the jugglers of India, who consider its ugliness an attraction. The cartilage of the nose is capable of extension, and the lips of considerable protrusion, as may be seen if the spectator hold a morsel of fruit or biscuit at a proper

distance for exciting the animal to exert this faculty. The muzzle is elongated, and, as well as the ends of the feet, is whitish or yellowish. The



THE SLOTH BEAR.

forehead rises almost abruptly from the muzzle. Upon the under side of the neck and breast is a white mark, resembling the letter V or Y. With these exceptions, the fur is deep black, with here and there some brown

spots, and is rather long, particularly round the breast, in old specimens. In bulk it is about the size of the brown bear.

The food of this species, in its natural state, consists of fruits, honey, and the white ants, which are so numerous and destructive. It inhabits the mountainous parts of India, where some cavern is its retreat. In captivity it is mild but melancholy. A pair lived for some time in the Gardens of the London Zoological Society, very sociably, and often lay huddled together, uttering a kind of rattling, but low, whine, or purring, which was continuous and monotonous, but not entirely unmusical; indeed, it was termed by more than one who heard it their song. The paw was generally at the mouth when they made this singular noise.

In India, bears will often continue on the road, in front of a palanquin for a mile or two, tumbling and playing all sorts of antics, as if they were taught to do so. I believe, says Johnson, in his "Sketches" of that country, it is their natural disposition; for they are certainly the most amusing creatures imaginable, in a wild state. It is no wonder that they are led about with monkeys to amuse mankind. It is astonishing, as well as ludicrous to see them climb rocks, and tumble, or rather roll down precipices. If they are attacked by a person on horseback, they stand erect on their hind legs, showing a fine set of white teeth, and make a crackling kind of noise. If the horse comes near them, they try to catch him by the legs; and, if they miss him, they tumble over and over several times. They are easily speared by a person mounted on horseback.

Capers of the World-Renowned "Martin."

The drollest and most accomplished of all bears was the celebrated Martin, of Paris, whose dancing, climbing, curtsying, tumbling, begging, and many other antics, were the delight of every child in the metropolis, and of many grown-up children also. It is true, that the nursemaids endangered the lives of their charges, by holding them over the side of the pit in which he was kept; but as none did fall, they continued to amuse themselves and their nurslings at the same risk. One morning early, he very cleverly withdrew the bolts of his pit door, and sallied forth on his hind-legs to take a walk. The keepers of the garden had not risen; but the dogs were on the alert, and surrounded Martin, jumping and barking, half in play and half in earnest. This roused the men, who, rushing out to see what was the matter, beheld the beast in the midst of the canine troop, his tongue lolling out of his mouth, and an expression of fun and enjoyment in his countenance, which was indescribable.

Never was the malignant scowl, so often noticed in bears, from pulling the third eyelid half over the eye, seen in poor Martin's face; yet he be-

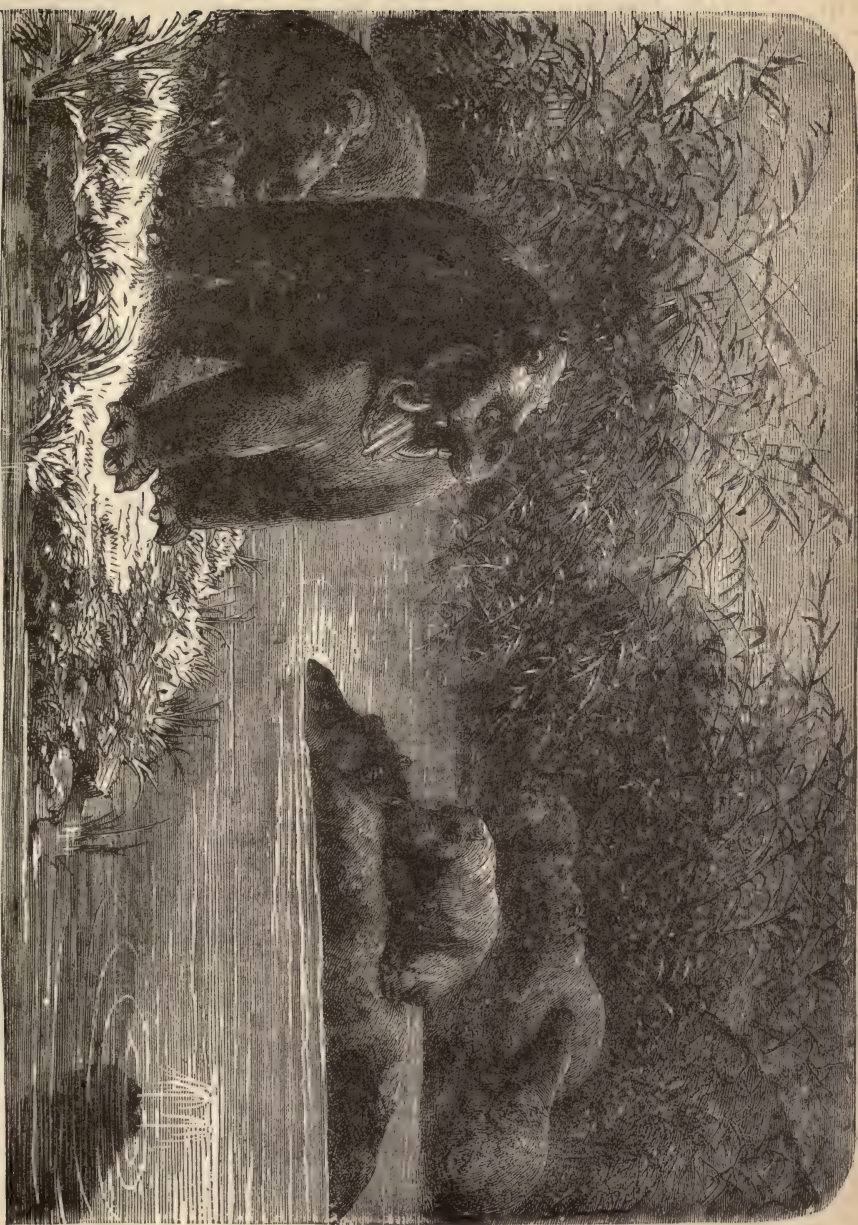
came unpopular from the cupidity of one of the sentinels. This man fancied he saw a five-franc piece lying in the bear's pit, and determined to go during the night, when he would be on duty, and secure it. He accordingly provided himself with a ladder, and when the guard was changed, was found lying lifeless at the bottom, the coveted piece in his hand, which proved to be nothing but a large button. No marks of violence were to be seen upon his body, but the contusions on his head seemed to tell that he had fallen from the ladder when near the top, and so met his death. Whether he had been frightened or seized with giddiness, or whether Martin had shaken the ladder, no one could say; the animal was sitting quietly by his side when his fate was first made known.

The story fled like wildfire from one end of Paris to the other, and in a short time the populace were fully convinced that Martin had killed him; and this, combined with other exaggerations, induced them to flock in multitudes to see the murderous bear. Afterwards, two balls of arsenic, wrapped up in some sweet substance, were found in the pit, fortunately before Martin had touched them; and the authorities of the garden thought it prudent to remove him to a den in the managerie. The front of these dens was closed at night with a sliding shutter, pulled down by inserting a hook at the end of a long pole into a ring, which ring when down, served to admit a bolt. This did not please Martin, and the keeper never could accomplish the fastening, till some one else went to the other side to take off the bear's attention; for the moment the shutter was down, Martin inserted his claws and pushed it up again, and this practice continued as long as he existed.

The Unwieldy Hippopotamus.

Hippopotamus, the Roman name, of Greek origin, for the river-horse, is still retained by modern zoologists as the generic appellation of these animals. They are natives exclusively of Africa, where—though much more limited than formerly in the range of their habitat—they inhabit the banks and beds of the larger rivers, and of the inland lakes from the Gariep to the upper Nile and its tributary branches. The hippopotamus is, however, not restricted to these, for it is also a marine animal. It is difficult to decide whether it prefers the river or the sea for its abode during the day. When there is an opportunity of choice, some select the sea, and others the river.

Scarcely, if at all, inferior to the elephant in bulk, this massive animal is much lower in stature, from the shortness of its limbs. Its body, like an enormous barrel supported on four thick pillars, almost touches the ground; the head is ponderous; the muzzle is swollen; and the great,



THE HIPPOPOTAMUS OR GIGANTIC RIVER-HORSE.

thick lips, studded with wire-like bristles, entirely conceal the projecting incisors of the lower jaw, and the huge curved tusks, or canines; the mouth is wide; the nostrils open on the top of the swollen muzzle; and the eyes, which are very small, are situated high on the head; hence, when in the water, the animal, by raising merely a small upper section of the head above the surface, can both breathe and look around—the body remaining submerged. The ears are small and pointed; the tail is short, and furnished with a few wiry bristles. The toes—four on each foot—are tipped with small hoofs. The hide is coarse, naked, and of great thickness.

This part is made into various articles, as shields, whips, and walking-sticks. Whips in Egypt are made of its skin, and form an important article of trade with the Sennaar and Dalfour caravans. To render the narrow strip pliable, they must be rubbed with butter or grease. In Egypt, where they are in general use, and the dread of every servant and peasant; they cost from half-a-dollar to a dollar each. In colder climates, even in Syria, they become brittle, crack and lose their elasticity.

Appearance and Habits of the River-Horse.

Between the skin and the flesh is a layer of fat, which is salted and eaten as a delicacy by the Dutch colonists of South Africa. Indeed, the epicures of Cape Town do not disdain to use their influence with the country farmers to obtain a preference in the matter of "sea-cow's speck," as this fat is termed, when salted and dried. The flesh, also, is excellent. The large canines are much valued by dentists, as they make from them better artificial teeth than can be obtained from the ivory of the elephant.

The general color of the hippopotamus is dusky, brownish-red, passing on the sides and limbs into a light purple, red, or brown; the under parts, the lips, and the eyelids, are light wood-brown, with a tinge of flesh-color; the hinder quarters and the under surface are freckled with spots of dusky brown; the hairs of the tail and ears are black, those on the muzzle yellowish-brown. The male far exceeds the female in size. The hippopotamus is gregarious, wary, and cautious.

These animals feed chiefly on grass, resorting to situations near the banks of rivers which supply that food. In districts fully inhabited by man they generally pass the day in the water, and seek their nourishment during the night; but in localities differently circumstanced, they often pass a portion of the day as well as the night on dry land. In countries in which the night-time constitutes the only safe period for leaving the water, they are exceedingly wary.

In Dargola, a narrow strip of country lying on both sides the Nile, the harpoon with which the natives attack the hippopotamus terminates in a flat, oval-shaped piece of iron, three-fourths of the outer rim of which are sharpened to a very fine edge. To the upper part of this iron one end of a long, stout cord is fastened, and the other is tied to a thick piece of light wood. The hunters attack the animal either by day or by night, but they prefer the former, as it enables them better to escape the assaults of their furious enemy. One part of the rope, with the shaft of the harpoon, the hunter takes in his right hand; in the left he holds the rest of the rope and the piece of wood. He now cautiously approaches the animal when he is asleep during the day on some island in the river, or he looks for him at night, when the hippopotamus is likely to come out of the water to graze in the corn fields.

When the huntsman is about seven paces from the beast he throws the spear with all his might, and, if he is a good marksman, the iron pierces through the thick hide, burying itself in the flesh deeper than the barbed point. The animal generally plunges into the water; and, though the shaft of the harpoon may be broken, the piece of wood which is attached to the iron floats on the surface, and shows what direction he takes. There is great danger should the hippopotamus spy the huntsman before he can throw his spear. He then springs forward with the utmost fury, and crushes him at once in his wide, open mouth.

As soon as the animal is fairly struck, the huntsmen, in their small canoes, cautiously approach the floating wood, and, after fastening a strong rope to it, they hasten with the other end toward the large boat which contains their companions. The huntsmen now pull the rope, when the animal, irritated by the pain, seizes the boat with his teeth, and sometimes succeeds in crushing and overturning it. Meanwhile his assailants are not idle; four or five more harpoons are plunged into him, and every effort is made to drag the beast close up to the boat, so as to give him less room to plunge about in. Then they try to divide the strong ligament that holds the head in its place, with a sharp weapon, or to pierce his skull. Since the body of a full-grown hippopotamus is too bulky to be pulled out of the water without a great number of hands, they generally cut him up in the river, and bring the pieces to land.

Story of an Imported Hippopotamus.

In May, 1850, the good ship "Ripon" steamed up to her berth in the Southampton Water, and various strange sights did she present to inquiring eyes. The most striking was an aged Arab of noble bearing, but by

no means clean, looking calmly out of one of the ports ; and, next in interest, a young one, who outdid all the boys on the quay could do, by drawing out of his ragged dress a splendid cobra, whose hiss, and the spreading of whose hood, had no chance of a parallel. A dark-skinned Nubian, who went by the name of Hamet, had arrived with the first hippopotamus that had reached Europe since the Emperor Commodus



"OBAYSCH"—FIRST HIPPOPOTAMUS TRANSPORTED TO EUROPE.

slaughtered five of these huge animals in the Flavian Amphitheatre at Rome.

His Highness Abbas Pasha, with great liberality, had the animal brought to Cairo at his own expense, from the White Nile ; a lieutenant

and a party of ten Nubian soldiers formed his escort; a boat had been built on purpose for him.

Hantet, whose services had been engaged at Cairo, from his experience and skill in the care and management of animals, had some amusing incidents to relate as to his extraordinary charge. It was clear, for instance, that he had attracted to himself, and that most deservedly, the warm affections of Obaysch, the name given to the animal from the place where he was captured. Thus, Hamet slept side by side with him at Cairo, and in the same way he slumbered during the first week of the voyage. But as the weather grew warmer, and Obaysch larger and larger, though "poverty makes us acquainted with strange bedfellows," the charge of a hippopotamus did not necessarily, it was thought, render such an inconvenience imperative. Hamet had, therefore, a hammock slung from the beams immediately over the place where he used to sleep—just over, in fact, his side of the bed, his position being raised some two or three feet. Assuring Obaysch, not only by words, but by extending one arm over the side so as to touch him, Hamet got into his hammock and fell asleep, when he was suddenly awaked by a jerk and a hoist, only to find himself close by the side of his companion. Another experiment at separate sleeping was attended by the same successful movements on the part of Obaysch, and, till they arrived at Southampton, Hamet desisted from any further trial, as he avoided, in all ways, any irritation of the animal.

Recently, a female hippopotamus, was safely deposited in the gardens of the Zoological Society. It was ascertained, during the voyage, that she was not insensible to music, for, when any one of the musicians on board played his instrument near her, she invariably raised her head in the attitude of listening. The keeper, also, an Arab snake-charmer, was in the habit of exciting the attention of his charge by a kind of musical call, which she answered by vibrating her great bulk to and fro, with evident pleasure, keeping time to the measure of the keeper's song. At the date just mentioned she was about four months old, and weighed above a ton. She was fed by her keeper opening her mouth with his hand, which he thrust down her throat, covered with milk and corn-meal.

CHAPTER IX.

REMARKABLE TYPES OF ANIMAL LIFE.

The American Puma—Killing Prey for the Sake of Killing—Two Hunters in the Catskills—A Sportsman's Shocking Death—Singular Encounter with a Puma—Power of Gentleness upon the Brute Creation—The Great Grizzly Bear—A Clumsy Creature—Blind Bears Regaining Sight—The Famous Jungle Bear—Claws of Unique Construction—Hunters' Ingenious Methods of Capture—How the "Jungler" Acts in Captivity—The Bear's Song—The Hedgehog—A Prickly Covering—A Long Winter's Sleep—The Hedgehog Proof Against Poison—The Eternal Foe of Serpents—The Brazilian Porcupine—A Creature with an Extraordinary Armor—Classic Legends Concerning the Porcupine—An Animal that Lacks Brains—Common Porcupine—Method of Showing Anger—A Quadruped Rolled up like a Ball—The Armadillo—A Thick Coat of Mail—A Rapid Digger in the Earth—A Bone-Covered Ball—Tumbling Unhurt Down a Precipice—A Sense of Wonderful Acuteness—The Scaly Ant-Eater—A Toothless Animal—Scales like those of a Fish—The Agile Kangaroo—Curious Pouch for Carrying Young—A Long Leaper—Hard Fighters—American Opossum—A Lover of Barn-yards—Odd Method of Transporting Little Opossums.



THE puma, sometimes called the cougar, has a very extensive range over both North and South America. The total length of the adult is from four feet to four feet and a half, that of the tail from two feet to two feet and a half. The females are somewhat less. The fur is thick and close, of a reddish-brown, approaching nearly to the color of a fox on the back. It lightens on the outsides of the limbs and on the flanks, and on the belly becomes of a pale reddish white. The muzzle, chin, throat, and insides of the legs, are grayish-white, and on the breast the color becomes more marked, and is almost pure white. The part from which the whiskers spring, and the lips and the backs of the ears, are black; the whiskers themselves white. On the face and flanks of the young animal there are some indications of stripes or brindling; but when the puma reaches maturity these are lost, and the color becomes entirely uniform, except where it shades into a paler tint.

Though very active in climbing, this animal seems more to frequent the grassy plains of the southern part of America and the marshy meadow lands bordering the rivers, than the forest, and is found in a country so open as to be frequently taken by the lasso, when attacking the herds. In the northern districts it inhabits the swamps and prairies, living chiefly on

different species of deer, on which it is said to drop down from a tree, which it had ascended to watch their path; or it makes inroads on the bogs of the squatter, who has gone to the unopened country. Other kinds of food, are sought after and taken without much discrimination.

Unlike most of the other animals of the tribe, it is not satisfied with the seizure of a single prey, but, when meeting with a herd of animals, will kill as many as it can, sucking only a small portion of the blood from each. It is thus extremely destructive among sheep, and has been known to kill fifty in one night. Active means are therefore constantly required for its destruction, and it is either hunted, speared, or shot.

Fatal Encounter in the Catskills.

Two hunters went out in quest of game on the Catskill Mountains, in New York, each armed with a gun and accompanied by his dog. It was agreed between them that they should go in contrary directions round the base of the hill, and that if either discharged his piece, the other should cross the hill as expeditiously as possible, to join his companion in pursuit of the game shot at. Shortly after separating, one heard the other fire, and, agreeably to their compact, hastened to his comrade. After searching for him for some time without effect, he found his dog dead and dreadfully torn. Apprised by this discovery that the animal shot at was large and ferocious, he became anxious for his friend, and assiduously continued the search for him; when his eyes were suddenly directed, by the deep growl of a puma, to the large branch of a tree, where he saw the animal crouching on the body of a man, and directing his eyes towards him, apparently hesitating whether to descend and make a fresh attack on the survivor, or to relinquish his prey, and take to flight.

Conscious that much depended on celerity, the hunter discharged his piece, and wounded the puma mortally, when it and the body of the man fell together from the tree. The surviving dog then flew at the prostrate beast; but a single blow from his paw laid him dead by his side. Finding that his comrade was dead, and that there was still danger in approaching the wounded animal, he retired, and, with all haste, brought several persons to the spot, where the unfortunate hunter and both the dogs were lying dead together. The skin of this animal was preserved in the Museum of New York, as a memorial of the story.

Curious Adventure With a Puma.

The following curious encounter with a puma is related by Sir E. Head, in his "Journey Across the Pampas:" The fear which all wild animals in America have of man is very singularly seen in the Pampas. I often rode towards the ostriches, crouching under the opposite side of my



horse's neck; but I always found that, although they would allow any loose horse to approach them, they, even when young, ran from me, though little of my figure was visible; and when I saw them all enjoying themselves in such full liberty, it was at first not pleasing to observe that one's appearance was everywhere a signal to them that they should fly from their enemy. Yet it is by this fear "that man hath dominion over the beasts of the field," and there is no animal in South America that does not acknowledge this instinctive feeling. As a singular proof of this, and of the difference between the wild beasts of America and the Old World, I will venture to relate a circumstance which a man sincerely assured me had happened to him in South America:

He was trying to shoot some wild ducks, and, in order to approach them unperceived, he put the corner of his poncho (which is a sort of long, narrow blanket) over his head, and crawling along the ground upon his hands and knees, the poncho not only covered his body, but trailed along the ground behind him. As he was thus creeping by a large bush of reeds, he heard a loud, sudden noise, between a bark and a roar: he felt something heavy strike his feet, and, instantly jumping up, he saw, to his astonishment, a large puma actually standing on his poncho; and, perhaps, the animal was equally astonished to find himself in the immediate presence of so athletic a man. The man told me he was unwilling to fire, as his gun was loaded with very small shot; and he therefore remained motionless, the puma standing on his poncho for many seconds: at last, the creature turned his head, and walking very slowly away about ten yards, he stopped and turned again: the man still maintained his ground, upon which the puma tacitly acknowledged his supremacy, and walked off.

Making Pets of Wild Beasts.

The puma is very easily tamed, and becomes harmless, and even affectionate. Kean, the actor, possessed one, called "Tom," which followed him about, and was often introduced to company in his drawing-room. Another was extremely gentle and playful, and showed no symptoms of ferocity to strangers who went to see it. It rejoiced greatly in the society of those to whose company it was accustomed; laid down on its back between their feet, and played with the skirts of their garments, exactly like a kitten. It was very fond of water, frequently jumping into and out of a large tub, greatly pleased with the refreshment.

It was brought from the city of St. Paul's, the capital of the district of that name, in the Brazils. During its voyage it was on intimate terms with several dogs and monkeys, none of which it ever attempted to

injure ; nor did it even attempt to return the petty insults which the latter sometimes offered. But if an unfortunate fowl or goat came within its reach, it was immediately snapped at and killed. While in London, it escaped into the street during the night, but allowed itself to be taken by a watchman, without offering even a show of resistance. After its arrival in Edinburgh, it was not indulged with living prey, and the only animals



GRIZZLY BEAR AND ITS PREY.

which fell victims to its rapacity were a duck and cock-pheasant, both of which approached inadvertently within the circle of its spring, and were each killed by a blow of its fore paw.

The grizzly bear is to the animal tribes of America what the Bengal tiger is to those of Hindostan and the lion to those of Central Africa. It is the most savage of its race and the most tenacious of life of all quadrupeds. The European brown bear and the American black bear are

closely allied, and are similar in habits, although the former is fiercer and more sanguinary. They are excellent climbers, passionately fond of honey, great devourers of roots and green corn, and especial enemies to hogs and small calves.

The grizzly bear is larger, heavier, clumsier and stronger, than the others. It easily crosses broad streams by swimming and when enraged even attacks its enemy in the water. It is not afraid of man and many a hunter has fallen a victim to its powerful claws and jaws. Indians and trappers relate wonderful stories about its ferocity and strength. The tenacity of life of the grizzly is very great and a wound that does not kill it right out, is often more dangerous to the hunter than to the bear itself. For this reason the Indians consider the killing of a grizzly as a proof of prowess of the young warrior, even more so than the slaying of an enemy. A necklace of the claws and teeth of a grizzly is considered one of their greatest and most honoring ornaments, because the Indian is not allowed to wear it, except he killed the bear himself.

Restoring Sight to Blind Bears.

It is said that the mere scent of man causes the grizzly to run away. The other animals are as much afraid of the scent of the grizzly, as this animal is of that of man. In captivity the grizzly does not act differently from its European cousins. Two grizzly bears in the Zoological Garden of London became utterly blind and it was resolved to perform an operation on them. By administering chloroform they were stupefied, and then the operation was performed. When they came to, they staggered about as if recovering from drunkenness, but later on seemed to enjoy the regaining of their eyesight.

A Creature with Monstrous Claws.

The home of the jungle bear is the continent of Asia, especially the southern part, and the Island of Ceylon. It frequently is found in mountains and solitary forests, and also near the habitations of man. On the isle of Ceylon, during the great drouth, it left its hiding places, and was met so often by the inhabitants that the women had to relinquish their accustomed baths and ablutions in the rivers. These bears frequently frightened them away, yet without any intention, because they have fallen into the river while drinking, and on account of their clumsiness are not able to gain dry land.

During the hot hours of the day the jungle bear rests in self-dug holes. It is very sensitive to heat, and suffers greatly when forced to cross the hot and dry mountain plateaus. Its soles are nearly scorched by the heat, so much so that it is sometimes unable to walk.



THE JUNGLE BEAR OF SOUTHERN ASIA.

The hunters therefore wait until the bear is nearly exhausted by the heat before they attack it. It generally appears to be harmless while traveling through the mountains, but becomes very dangerous when wounded. Roots, fruits, bees and their hives, worms, snails and ants are its main nourishment, and its long and strong claws assist it in finding roots or opening an ant-hill. It climbs the highest tree to procure bees or ants. It is very docile after being captured, and is easily taught all kinds of tricks. In captivity it is fed with milk, bread and meat. For hours it lays on its belly and amuses itself by licking its paws. It is unconcerned about what happens around it. Its fat is considered to be a never-failing remedy against rheumatism and gout.

A pair of jungle bears were kept for some time in the gardens of the Zoological Society, London. They lived very sociably, and often lay huddled together, uttering a kind of rattling but low whine, or purring, which was continuous and monotonous, but not entirely unmusical; indeed, by more than one who heard it, it was termed their song. The paw was generally at the mouth when they made this noise.

The Hedgehog.

The common hedgehog, an insectivorous animal, has a heavy form, short limbs, and slow motion. The upper part of the body is covered with sharp prickles about an inch long, arranged in clusters, divergent and crossing each other, of a brownish-black with a white point; the head is clothed with hard, brownish hairs and the under part of the body with a dirty white fur. The five toes are armed with long nails, the middle the longest, suitable for digging. The soles are covered with naked tubercles, possessing an exquisite sense of touch.

The animal is able to roll itself into a ball and preserve this attitude as long as it pleases without much effort, presenting to its enemies a thorny mass, which the most voracious and powerful dare not attack. The hedgehog conceals itself during the day in burrows or natural holes, coming out at night in search of worms, insects, snails and fruits. There is no hedgehog in America; the porcupine, armed with quills, is sometimes called by this name.

The usual residence of these animals, which are found in the temperate parts of Asia and Europe, is in thickets. It may be in some degree rendered domestic, and has been frequently introduced into houses for the purpose of destroying cockroaches and beetles, which it pursues and devours with great avidity. At the commencement of winter the hedgehog wraps itself up in a warm nest of dried moss, grass, or leaves, and sleeps out the rigors of the season. When taken out and placed before a fire it

soon recovers from torpidity. The female produces from three to six blind ones at a birth, which are soon covered with prickles, like those of the parent animal.

The hedgehog is said to be very delicate eating. The skin was used by the ancients for the purpose of a clothes brush. The most violent animal poisons have no effect on the hedgehog. This renders it of peculiar value in forests, where it destroys a great many noxious reptiles. Fights between the hedgehogs and vipers have been witnessed, in which, after a very severe and prolonged encounter, the hedgehog seized the viper by



THE PRICKLY HEDGEHOG.

the head, which it ground between its teeth, compressing the fangs and glands of poison, and then devouring every part of the body. The hedgehog received several wounds on the ears, mouth, and even the tongue, without appearing to experience any of the ordinary symptoms produced by the venom of the viper. According to physiological notes it is not easily understood, how a warm-blooded animal could stand the bites of the viper, which would cause the decomposition of the blood in other animals and occasion death.

The Brazilian tree-porcupine is abundant in Guiana, Brazil and Bolivia,

and feeds on the fruit of palms. Like its cousins it sleeps during the day sitting on a tree. It greatly dislikes to be touched and by a sudden movement tries to intimidate any one who approaches it. When caught by the tail it becomes tame and pliable and then can be taken on the arm without trying to bite. When irritated, it erects its quills and then appears to be twice as large as it really is

The ancients were acquainted with the porcupine, and Aristotle alludes to the story of its power in shooting its quills to a distance at its enemy, showing that this illusion had thus early taken possession of the popular mind. The tale is dwelt upon by Pliny with his usual love of the marvelous, and Ælian, Oppian, and Claudian have repeated the story with exaggerations. In suddenly raising his spiny armor, a loose quill may be detached by the porcupine, but the power of throwing them to a distance does not exist except when shedding its coat.

A Creature with a Formidable Armor.

The use of the quills is simply that of a defensive armor, but as this seems a cumbrous device for such a purpose, we are led to insist on finding other advantages to be derived from them. Hence, Thunberg tells us that he was informed that the Ceylonese porcupine had a very curious method of fetching water for its young, namely, the quills in the tail are said to be hollow, and to have a hole at the extremity, and the animal can bend them in such a manner as that they can be filled with water, which afterward is discharged in the nest among the young. Such inventions, to help nature out, so as to satisfy a narrow conception of her works, are doubtless the source of many of the common-place errors in respect to animals of peculiar organization; but the truth certainly is, that the porcupine finds his quill armor an exceedingly convenient, useful, and effective defence, and he would be as imperfect without it as a wasp without its sting, or a cock without its spurs.

The porcupine is an exceedingly stupid creature, and hence, no doubt, nature supplied him with his formidable covering as a compensation for his lack of brains; as an indispensable provision in order to put him on a level with other brutes of his order. The modes by which nature equalizes her favors are infinitely diversified: some animals she endows with instincts, some with gifts analogous to reason, some with strength, some with dexterity, some with defensive or offensive weapons. The hare has speed, the squirrel activity, the marmot caution, the beaver ingenuity, the rat most or all of these qualities; the porcupine, destitute of all, has his quiver of arrows, which he shakes in the face of his foe, to frighten him if he is a coward, and to pierce him if he has the courage to make an at-

PORCUPINE AND ITS YOUNG.



tack. In case of need, he will run backward at his enemy, and thus strike his sharp-pointed arrows into him. Without his quills, the porcupine would seem to be a singularly unmeaning, uncouth, and helpless sot; with them, he has a position in history, and figures in literature as the emblem of human fretfulness and conceit.

Rodents are called the animals which are furnished with two remarkably large and long front teeth in each jaw, but which have no canine teeth. Their feet have claws and are formed for leaping as well as for running. The porcupines, which belong to this family, have two front teeth, set obliquely in each jaw, and grinders; they have four toes on the fore and



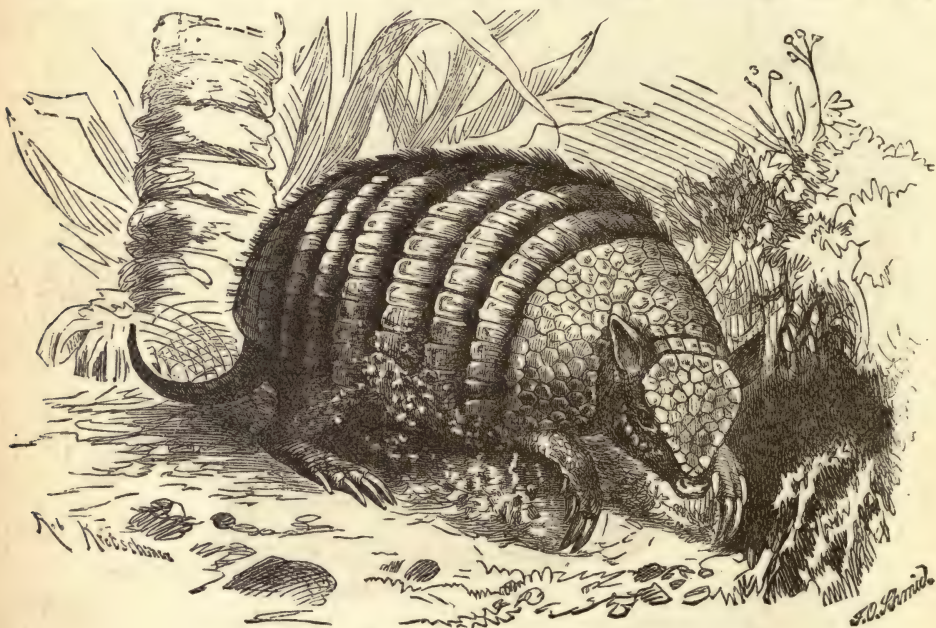
THE COMMON PORCUPINE OF CANADA.

five on the hind feet, and the body is covered with spires intermixed with hair. To the hedgehog they have a further similitude than in the spiry covering of their bodies. The best known species is the Canada porcupine, about two and one half feet long, weighing from twenty to thirty pounds. It appears larger than it really is, from the length of the hair and spires.

The fur is generally dark brown, soft, woolly and grayish next the skin; coarse and bristly in some parts, six or seven inches long on the back; the coarse hair usually having dirty white points, giving to the whole a hoary tint. The spires more or less hidden by the fur and abundant on the upper surface of the head, body and tail, are several inches long, and white with dark points. It is found between northern Pennsylvania and

to the east of the upper Missouri River. It is an excellent, though a slow climber, is not able to escape its enemies by flight, but cannot be attacked even by the largest flesh-eaters with impunity.

Dogs, wolves, the lynx and the cougar have died, from the inflammation produced by its quills. These are loosely attached to the skin and barbed at the point, so that they easily penetrate, retain their hold, and tend continually to become more deeply inserted. When irritated, it erects its quills, and by a quick lateral movement of the tail, strikes its enemy, leaving the mouth, nose and tongue beset with its darts. Whenever these animals are irritated or offended, they stamp forcibly on the ground with



BONE-PLATED ARMADILLO.

their hind feet, somewhat in the manner of rabbits, making at the same time a kind of grunting noise.

The usual method of defence adopted by these animals is to recline on one side, and at the approach of their enemy to rise up quickly, and gore him with the erected quills of the opposite side. It is stated that when the porcupine meets with serpents, against which it carries on a perpetual war, it closes itself up, like a ball, concealing its head and feet, and then rolls upon and kills them with its bristles, without running any risk of being wounded itself.

This armadillo belongs to a family of mammals, intermediate between the

sloths and ant-eaters. They are distinguished by the possession of molar teeth only, and have a singular coat-armor covering their whole body and head. It consists of three bony bucklers embracing the head, shoulders and rump, the two latter solid and capable of little movement, but connected by transverse bands of smaller plates, which are very pliable and elastic. The tail is armed with an annular band. The legs are short and stout, covered with scaly plates, and furnished with powerful claws for burrowing in the ground. The teeth are cylindrical, varying from seven



ARMADILLO ROLLED UP AND ERECT.

to eighteen in number on each side of each jaw, and when the mouth is closed they shut one into another.

The armadillos are mostly nocturnal, and perfectly inoffensive; they run with great speed, easily outstripping a man, but when pursued immediately commence burrowing with rapidity. Their ordinary food consists of fallen fruits, roots, worms, ants and carrion. When the armadillo is in danger of being attacked by its enemies, it rolls itself up in the manner of the hedgehog, and, except its nose, leaving nothing but the shell in view.

In this position it sometimes resembles a large ball flattened at the

sides, and it continues in this position till the danger is past, and frequently for a long time afterwards.

If the animal happens to be near a precipice, it will sometimes roll itself over, and generally falls to the bottom unhurt. These animals root up the earth in search of food; they live in burrows, which they dig in the ground, and which they seldom quit, except during the night. Although they are natives of the hot climates they will live in temperate regions. They are hunted with small dogs, which are trained up for this purpose. The hunters know when they are concealed in their holes by the number of flies which then hover round, and their usual mode of forcing them out is by smoking the burrows or pouring in water. If they begin to dig, the animal digs also, and, by throwing the earth behind it, so effectually closes up the hole that the smoke cannot penetrate. The Indians are very fond of the flesh of the armadillo.

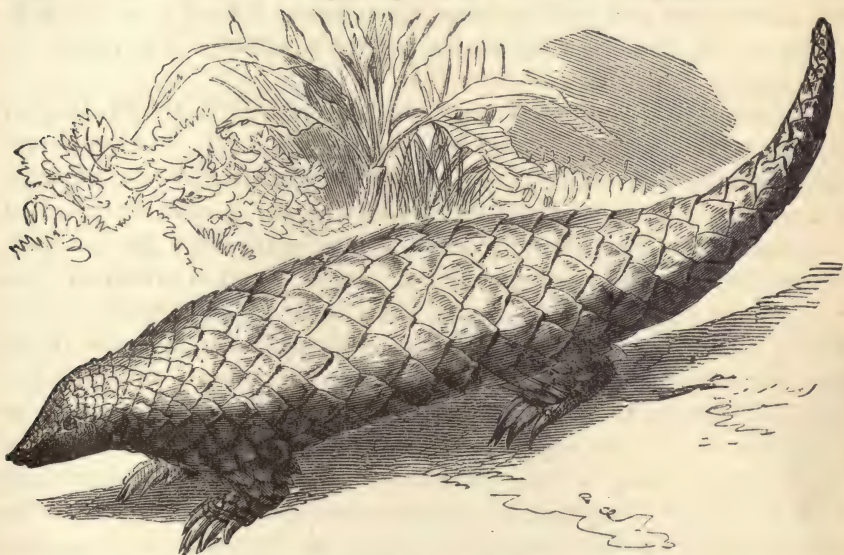
The armadillos see but indifferently, particularly in bright sunshiny weather; but their sense of hearing is extremely acute, and amply compensates for any imperfection of sight. When alarmed by any unusual or strange sound they prick up their ears, stop for a moment to satisfy themselves of its distance and direction, then commence a precipitate retreat to their burrow, or, if that be too remote, begin to construct a new one. Smell is, however, by far the most acute of their senses. Azara tells a singular story, which strikingly illustrates the intensity of this sense in the armadillos, as well as the unerring certainty with which, by a kind of intuitive knowledge of the principles of engineering, they are enabled to direct their subterraneous course to any particular point. Having arranged a trap for the purpose of taking armadillos, and having placed in it, by way of bait, a cock with a small quantity of maize to support him, it so happened that a few grains of the maize fell through between the boards which formed the bottom of the trap. An armadillo arrived during the night, and wishing to get at the maize thus accidentally spilt, opened a trench or burrow at some distance from the trap, and without deviating a hair's breadth from the straight line of his direction, pushed it on to the very spot where the grain had fallen, and possessed himself of the booty.

The Pangolin or Scaly Ant-Eater.

A burrowing toothless mammal is found in the warm parts of Africa and Asia, living in holes, which it digs in the ground or in hollow trees and feeding upon insects, especially ants. The largest species is the short-tailed pangolin, three or four feet long; it is found in India or Ceylon; the scales are deep brown in the adult animal, and hard enough to

turn a musket ball. The flesh of the pangolins, which are probably the best protected of mammals against carnivora, is delicate and much prized by the natives of Africa.

The pangolins have no teeth ; their mouth is long and tubular, and the tongue cylindrical, and extensile. In their general appearance these animals greatly resemble the lizards. They are, however, truly mammiferous animals, bringing forth living offspring and nourishing them in the same manner as other quadrupeds. The scales with which the bodies of these extraordinary animals are covered, are not attached to the skin by their whole under surface, but only by their lower extremities, and thus, like the quills of the porcupine, are movable at pleasure. When



THE SCALY ANT-EATER.

exasperated the animals erect them, and when attacked, they roll themselves into a ball and present to their enemy a surface armed on every side.

The scales are sharp at the points and of a substance so hard, that on collision, they will strike fire like flint. The mode in which these animals feed is similar to that of the ant-eaters. They lay down in places frequented by insects and extend their long, cylindrical tongue upon the ground ; the insects are attracted by the viscoous fluid with which it is covered, and run upon it in great numbers. When the animal finds that its tongue is sufficiently covered, it suddenly withdraws it and swallows its prey.

The kangaroo is a marsupial animal, that is, an animal with a pouch for carrying its young. It is peculiar to Australia and the neighboring islands. The fore limbs are usually very small in proportion to the hind legs, which are large and powerful. Kangaroos are vegetable feeders, browsing like ruminants, and, like these, occasionally chew the cud. They vary in height from that of a hare to that of a man. When browsing, they apply the fore feet to the ground, but at other times rest upon the tripod, formed by the hind legs and powerful tail with the forepart of the body inclining slightly forward. They are the only marsupials which are not of nocturnal habits.

The largest and best known species is the great kangaroo discovered in 1770 on the coast of New South Wales during Cook's first voyage. An adult male in the British Museum measures more than five feet from the tip of the nose to the root of the tail, the latter being three and one-half feet additional; the female is about one-third smaller. The hair is moderately long and soft, of a general gray-brown above and paler below, and end of the tail black. It prefers low grassy hills and plains, and open districts, where it browses upon the herbage and low bushes. The fore feet are prehensile, or adapted to seizing and grasping, and are used in the various offices connected with the care of the young. Kangaroos are not generally gregarious, but live in families; their skin is valuable for leather, which is esteemed for shoes and gloves; the flesh is also considered a delicacy.

Terrible Fighters.

Kangaroos have vast strength in their tail; this they occasionally use as a weapon of defence, for they are able to strike with it so violent a blow as even to break a man's leg. But this is not their only weapon, for when hunted with dogs they use both their claws and teeth. On the dogs seizing them they turn, and catching hold with the nails of the fore paws, strike the dog with the claws of their hind feet, and sometimes lacerate his body in a shocking manner.

The kangaroo generally feeds standing on its four feet, like other quadrupeds, and it drinks by lapping. In a state of captivity it sometimes springs forward and kicks in a forcible manner with its hind feet, during which action it props itself on the base of its tail. It has a singular faculty of separating to a considerable distance the two long fore teeth of the upper jaw.

Singular Arrangements for Carrying the Young.

The female seldom produces more than one young one at a birth, and so exceedingly small is this that it scarcely exceeds an inch in length, and



A FAMILY OF KANGAROOS.

weighs but twenty-one grains. It is received into the abdominal pouch of the mother. At this period of its growth its fore paws are comparatively large and strong, and the claws extremely distinct, to facilitate its motion during its residence in its mother's pouch. The hind legs, which are afterwards to become very bony and stout, are then shorter and smaller than the others.

The young one continues to reside in the pouch till it has nearly attained maturity. It occasionally creeps out for exercise or amusement, and even after it has quitted this retreat it often returns to



OPOSSUM CARRYING ITS YOUNG.

it for shelter on the least indication of danger. Kangaroos live in burrows under the ground and subsist on vegetable substances, chiefly grass; when they feed in herds of thirty and forty together, as they sometimes do, one of the herd is generally stationed as a guard at a distance from the rest. Their eyes are furnished with winking membranes, capable of being extended at pleasure entirely over the ball.

From the general form and structure of the kangaroo it is evident that its chief progressive motion must be by leaps; in these exertions it has been seen to exceed twenty feet at a time, and this so often repeated as almost

to elude the fleetest grey-hound, and it is able with ease to bound over obstacles nine feet or more in height.

The American Opossum.


The opossum, found in the southern part of our country, has a pointed head, wide gape, numerous sharp teeth, a rough tongue, ears large and naked, small eyes, the tail long, tapering, flexible, and prehensile; the toes are armed with sharp, strong, curved claws. In its habits it is mostly nocturnal and arboreal, feeding alike upon insects, eggs, birds and fruits. It sometimes invades the barn-yards, and destroys the poultry, it is said, for their blood. It is a good deal hunted, and manifests much dexterity in escaping, by creeping away amid the grass, and sometimes pretending to be dead. In defending itself it bites severely. It is sluggish in its movements, and will sometimes lie on its back in the sun for hours; it often suspends itself from the brush of a tree by its tail. It is very prolific, producing from six to fifteen at a birth. The young at this period are well formed, and weigh from three to four grains each. As soon as produced, they are shoved into the pouch by the mother with her snout, and there find their food by instinct. Their growth is very rapid; at a week old they weigh thirty grains. They remain in the pouch till they are able to move about. At the age of four weeks they may be seen peeping out of their sack; a week afterward they venture forth, but keep close to the mother, and hold on to her by their tails, often riding on her back.

Sometimes with a dozen young ones of the size of rats, thus clinging around her legs, neck and body, and some of them dragging along on the ground, she may be seen going about in search of food. At this age these animals are pretty. They remain with their mother till about two months old; they then learn to take care of themselves, but continue in the vicinity, seeming still to be under maternal guardianship in a certain degree. Meantime another litter is produced, and during the season a third, and some of all these may be seen at once with their prolific parent. In winter, if the climate is cold, the opossums become sluggish, but not torpid like the woodchuck. They are common in all the Southern and Southwestern States, and in California and Mexico. They are also found in the Middle States as far north as Pennsylvania, and sometimes in New Jersey.

CHAPTER X.

WILD SPORTS IN THE TROPICS.

The Bulky Elephant—Tale of the Assyrian Queen—Panic and Frightful Carnage—Ivory Palaces—Thrones of Elephants' Tusks—Elephant Gymnasts—The Monster Frightened by a Horse—Revenge for an Insult—Droves of Game—Passionate Cry and Wild Rush—A Situation Apparently Hopeless—At the Mercy of the Infuriated Beast—Exploits of Jan Wildeman—A Frightened Scotsman—Immense Quantities of Ivory—Baldwin Pursued by an Elephant—Miraculous Escape—Exciting Chase—Goatskin Clothing Torn to Shreds—The Rhinoceros—Powerful Animal—Hunted with Elephants—Terrible Weapon of Attack and Defense—Story of a Desperate Fight—Hunting Rhinoceroses with Horses—Strange "Rhinoceros Birds"—Mad Beast Attacking Hunters—Lucky Shot—"Fire-Eating Rhinoceros"—Routing a Camp at Night—Horse Saved by a Bullet—Sudden Upset of a Wagon—Helping the Young to Escape—Vast Size of the Hippopotamus—Anger Easily Aroused—Manner of Hunting the River-Horse—Hiding Under Water—Cumming's Adventure with a Hippo—Man and Beast Splashing in the Water Together—Unique Surgical Operation—Steering the Huge Creature Ashore—Boat Smashed by a Sea-Cow—Snatched from Devouring Jaws—Crocodiles Startled from Slumber—Dangers of Gorilla Hunting—Fierce Aspect of the Gorilla—Amazing Power of the "Wild Man"—Elephants Routed by Gorillas—The Fleet Ostrich—Modes of Capturing the "Flying Camel"—Hunters' Disguise—A Flying Run—Baldwin and Andersson's Adventures—Concern of the Old Birds for their Young.

F we go back, desirous to trace the earliest knowledge of the elephant, we are lost in traditions referring to heroes or kings whose names survive, but of whose acts, however famous, no record remains. Thus, Bacchus, one of the conquerors of India, is said to have been the first that yoked the elephant to a car; and, according to Lucian, he brought not only gems, but the bones of elephants from Ethiopia, which were deposited in the temple of Dea Syria.

Throughout the Iliad of Homer, ivory is but once mentioned, and that notice occurs in the description of the bit of a horse's bridle, belonging to a Trojan. But in the Odyssey, the palace of Menelaus, after his return from his voyages in Egypt and Phœnicia, is enriched with ornaments of ivory, as well as amber and gold. Of the union of gold and ivory of the Greeks and Romans in works of art, we have many accounts.

Ancient historians, such as Diodorus, the Sicilian, relate the following tale:—Semiramis, the Assyrian Queen, longed for the conquest of India,

but dreaded the elephants which Stabrobates, the king she purposed attacking, could bring into the field. She therefore directed 300,000 black oxen to be slain, and of the skins, sewn together and stuffed with straw, artificial elephants to be formed, so that each one might be carried by a camel, and directed by a man. All this being secretly done, and the horses of the army familiarized with the machines, Semiramis took the field at the head of an immense force of cavalry and infantry. Stabrobates, meanwhile, had increased the number of his elephants, and furnished them completely with offensive and defensive armor. He sent ambassadors to the Queen with protests against her invasion and threats of her destruction, but her reply was a smile, and proceeding to the Indus she sank a thousand of his vessels, and took a great number of captives. Stabrobates feigned a panic, and fled; the feint took; Semiramis crossed the river, and pursued the Indians with the greater part of her forces.

In her front she placed the artificial elephants. Stabrobates repented of his retreat when he heard of their number, but he was comforted by the tidings of deserters as to their true character. Semiramis, supposing the cheat undiscovered, led on the attack; the machines frightened the horses so that they threw their riders, or rushed with them among the enemy. But vain was the contention when the true elephants of Stabrobates came up; dreadful was the carnage. The Assyrians fled, and the life of their Queen, pierced in the arm by one of his arrows, and in the shoulder by one of his darts, was only saved by the fleetness of her horse.

Palaces and Thrones of Ivory.

The Scriptures contain no allusion to the elephant till the time of David, when we find mention is made of "ivory palaces." In the reign of Solomon ivory was imported by the vessels of Tharshish from India, with other productions of that country. We read of "a great throne of ivory," and afterwards of "benches and horns" of the same substance, as it formed part of the merchandise of "the proud city" of Tyre.

Half a century after the death of Alexander, in the battle of Heraclea (B. C. 280), were—

Cuirassiers all in steel for standing fight,
Chariots, and elephants indorsed with towers
Of archers.

It is stated in the history of the Maccabees, that in the army of Antiochus "to every elephant they appointed a thousand men, armed with coats of mail; and five hundred horsemen of the best; these were ready on every occasion; wherever the beast was, and whithersoever he went,

they went also; and upon the elephants were strong towers of wood, filled with armed men, besides the Indian that ruled them."

Hannibal crossed the Alps with elephants, considering them indispensable to the conduct of the war; and when they perished he was supplied with large reinforcements from Carthage. At the battle of Cannæ (B. C. 216), the incidents occurred which are thus given by Silius Italicus:

The yet prevailing Roman, to withstand
 The fury of these monsters, gives command
 That burning torches, wheresoe'er they go,
 Should be opposed, and sulph'rous flames to throw
 Into their towers. This, with all speed, obey'd,
 The elephants they suddenly invade;
 Whose smoking backs with flames collected shined,
 That, driven on by the tempestuous wind,
 Through their high bulwarks fire devouring spread,
 As when on Rhodope or Pindus' head
 A shepherd scatters fire, and through the groves
 And woods, like a hot plague, it raging moves,
 The leafy rocks are fired, and all the hills,
 Leaping now here, now there, bright Vulcan fills.
 But when the burning sulphur once begun
 To parch their skins, th' unruly monsters run
 Like mad, and drive the cohorts from their stand;
 Neither durst any undertake at hand
 To fight them; but their darts and javelins throw
 At distance: burning, they impatient grow,
 And, through the heat of their vast bodies, here
 And there, the flames increasing bear;
 Till, by the smooth adjoining stream, at last
 Deceiv'd themselves, into 't they headlong cast;
 And with them all their flames, that still appear
 'Bove the tall banks, till, both together, there,
 In the deep channel of the flood, expire.

In stately show these animals bore a conspicuous part:

Trampling the snows
 The war-horse reared, and the towered elephant
 Upturned his trunk into the murky sky.

In the year 802 an elephant was sent to Charlemagne by Haroun Al Raschid, caliph of the Saracens. Milton has said:

The unwieldy elephant
 To make them mirth used all his might, and wreath'd
 His lithe proboscis;

and, according to Ælian, the elephants of Germanicus were trained to take part in the performances of the Roman theatre. On one occasion twelve of the most sagacious and well-trained were selected, which marched

into the theatre with a regular step at the voice of their keeper, sometimes in a circle, and sometimes divided into parties, scattering flowers over the pavement. The Romans, after this display, feasted the elephants with prodigal luxury. Splendid couches were placed in the arena, ornamented with paintings, and covered with tapestry. Before the couches, upon tables of ivory and cedar, was spread the banquet of the elephants, in vessels of gold and silver.

On the preparations being completed, the twelve elephants marched in, six males clad in the robes of men, and six females attired as women. They laid down in order on their couches, and at a signal extended their trunks and ate with praiseworthy moderation. Not one of them appeared the least voracious, or manifested any disposition for an unequal share of the food or an undue proportion of the delicacies. They were as moderate also in their drink, and received the cups that were presented to them with the greatest decorum.

Elephants on the Tight Rope.

According to Pliny, at the spectacles given by Germanicus, it was not an uncommon thing to see elephants hurl javelins in the air, and catch them in their trunks, fight with one another as gladiators, and then execute a Pyrrhic dance. Lastly, they danced upon a rope, and their steps were so practised and certain, that four of them traversed the rope, or rather parallel ropes, bearing a litter, which contained one of their companions, who feigned to be sick. Such feats seem scarcely credible, but many ancient writers of authority agree with Pliny, that the elephants trained at Rome would not only walk forward along a rope, but retire backward with equal precision. And Busbequius, who visited Constantinople about the middle of the sixteenth century, there witnessed an elephant not only dance with accuracy and elegance, but play at ball with great skill, tossing it with his trunk and catching it again, as easily as a man could with his hands. An old writer tells us that Cæsar, having attempted, unsuccessfully, to cross the Thames, covered a large elephant which he had with him with a coat of mail, built a large turret on his back, and filling it with bowmen and slingers, ordered them to pass first into the stream. The Britons were terrified at the sight of this unknown and monstrous animal, and fled in the wildest confusion.

Matthew Paris relates that, about the year 1255, an elephant was sent over to England as a grand present from the King of France to Henry III. ; and states that it was believed to be the first and only elephant ever seen in England, or even on that side the Alps; and that, consequently, the people flocked in large numbers to behold so great a novelty on its arrival.



ELEPHANTS IN THEIR NATIVE JUNGLE.

Among the Close Rolls, one of about this date is extant, in which the Sheriff of Kent is ordered to proceed to Dover in person to arrange in what manner the king's elephant might be most conveniently brought over, and to provide a ship, and other things necessary to convey it; and directing that, if the king's mariners judged it practicable, it should be brought to London by water. Another order was shortly after issued to the sheriffs of London, commanding them to cause to be built, without delay, in the Tower of London, a house, forty feet in length and twenty in breadth, for the king's elephant; and directing that it should be so strongly constructed that, whenever there should be need, it might be adapted to and used for other purposes. Next year, the king, in like manner, commanded the sheriff "to find the said elephant and his keeper such necessaries as should be reasonable and needful."

The Huge Animal's Sagacity.

The tame elephant soon becomes reconciled to other domestic quadrupeds. He has been said to be afraid of the horse, but the experience of Sir Emerson Tennent favors the belief that it is the horse which is alarmed at the aspect of the elephant. Of this fact he records an instance, which we quote, because it illustrates at the same time the peculiar sagacity of the great animal, and illustrates also the disposition to make good use of his tusks, when he happens to have them: One evening, whilst riding in the vicinity of Kandy, my horse evinced some excitement at a noise which approached us in the thick jungle, and which consisted of a repetition of the ejaculation *urmph! urmph!* in a hoarse and dissatisfied tone. A turn in the forest explained the mystery, by bringing me face to face with a tame elephant, unaccompanied by any attendant. He was laboring painfully to carry a heavy beam of timber, which he balanced across his tusks; but the pathway being narrow, he was forced to bend his head on one side to permit it to pass endways; and the exertion and inconvenience combined, led him to utter the dissatisfied sounds which disturbed the composure of my horse. On seeing us halt, the elephant raised his head, reconnoitered us for a moment then threw down the timber, and forced himself backwards among the brushwood, so as to leave a passage, of which he expected us to avail ourselves. My horse still hesitated, the elephant observed it, and impatiently thrust himself still deeper into the jungle, repeating his cry of *urmph!* in a voice evidently meant to encourage us to come on. Still the horse trembled; and, anxious to observe the instinct of the two sagacious creatures, I forbore any interference—again the elephant wedged himself further in amongst the trees, and waited impatiently for us to pass him; and after the horse

had done so tremblingly and timidly, I saw the wise creature stoop and take up his heavy burden, trim and balance it on his tusks, and resume his route, hoarsely snorting, as before, his discontented remonstrance.

An Elephant's Revenge.

An elephant is said never to forget an insult. Wolf, in his "Voyage to Ceylon," relates the following anecdote: A person in that island, who lived near a place where elephants were daily led to water, and often sat at the door of his house, used occasionally to give one of these animals some fig-leaves—a food to which elephants are very partial. Once he took it into his head to play the elephant a trick. He wrapped a stone round with fig-leaves, and said to the driver, "This time I will give him a stone to eat, and see how it will agree with him." The driver answered, that the elephant would not be fool enough to swallow a stone. The man, however, handed the stone to the elephant, which, taking it with his trunk, immediately let it fall to the ground. "You see," said the keeper, "that I was right;" and, without further words, drove away his elephants. After they were watered, he was conducting them again to their stable. The man who had played the elephant the trick was still sitting at his door, when, before he was aware, the animal ran at him, threw his trunk around his body, and, dashing him to the ground, trampled him immediately to death.

The tenderest affection, it may be remarked, appears to subsist between the elephant and the calf. When merchants bring elephants to any place for sale, it is a pleasant sight to see them go along. There are old and young together, and when the old are gone by, the children run after the little ones, and leap upon their backs, giving them something to eat; but they, perceiving their dams are gone forward, throw the children off without hurting them, and double their pace. Bruce mentions that a young elephant came boldly out to defend its wounded mother, and ran upon the men and horses, heedless of its own life or safety, till one of the hunters ran it through with a lance.

Peculiar Instincts of the Great Beast.

The head of the African is smaller, rounder, more elongated, and less irregular than is that of the Asiatic kind; the ears are nearly twice as large, and the tail not above half the length. On the banks of the Fish river this animal abounds. As many as three thousand in a troop have been seen in that locality; indeed, the surrounding country appears to have been the abode of elephants for ages, the paths or beaten roads made by them intersecting it in all directions.

Of one territory, comprising an irregular area of about two million

acres, from which the Kaffirs were expelled, and which was resorted to by wild animals in considerable numbers, Pringle gives the following highly graphic account :

The upper part of this extensive tract is an exceedingly wild and bewildering region, broken into innumerable ravines, encumbered with rocks and precipices, and impenetrable woods and jungles, and surrounded on almost every side by lofty and sterile mountains. During our first day's journey, although we saw many herds of large game, such as quaggas, gnus, hartebeests, koodoos, with a variety of smaller antelopes, there was no appearance of elephants; but in the course of the second day, as we pursued our route down the valley of the Koonap river, we became aware that a numerous troop of these gigantic animals had recently preceded, as footprints of all dimensions, from eight to fifteen inches in diameter, where everywhere visible; and in the swampy spots on the banks of the river it was evident that some of them had been luxuriously enjoying themselves, by rolling their unwieldy bulks in the ooze and mud.

But it was in the groves and jungles that they had left the most striking proofs of their recent presence and peculiar habits. In many places paths had been trodden through the midst of dense, strong forests, otherwise impenetrable. They appeared to have opened these paths with great judgment, always taking the best and straightest cut to the next open savanna, or ford of the river; and in this way they were of the greatest use to us, by pioneering our route through a most difficult and intricate country, never yet traversed by a wheel-carriage, and great part of it, indeed, inaccessible even on horseback, except for the aid of these powerful and sagacious animals.

In such places (as the Hottentots assured me) the great bull elephants always march in the van, bursting through the jungle as a bullock would through a field of hops, treading down the thorny brushwood, and breaking with his proboscis the larger branches that obstruct his passage; the females and younger part of the herd follow in his wake in single file; and in this manner a path is cleared through the densest woods and forests, such as it would take the pioneers of an army no small labor to accomplish.

Almost Fatal Adventure.

A little squadron, engaged in surveys of Africa, Arabia, and Madagascar, on taking leave of the latter island, proceeded to the Bay of Delagoa. A party set out to ascend one of the rivers, for the purpose of hunting the hippopotamus. Whilst they were in quest of the haunts of these huge

animals, a shrill, angry scream reached their ears, and, presently a midshipman, rushed from the reeds, his face covered with blood, calling loudly



NATIVES OF SOUTH AFRICA CAPTURING AN ELEPHANT.

for assistance to Lieutenant Arlett, who had just been attacked by an elephant. The party proceeded to the spot, and found their unfortunate

comrade stretched motionless on his back, covered with blood and dirt, and his eyes starting from their sockets, in all the expressive horror of a violent death. It was some time before he showed any symptoms of life; they succeeded, however, in carrying him on board, where he gradually recovered; and, when he became sufficiently collected, he gave an account of what had befallen him, which shows the extraordinary sagacity of the elephant, even in its wild state. At the first approach of the animal, he thought he had stumbled on an enormous hippopotamus.

Struck Senseless to the Ground.

The animal, which appeared highly irritated at the intrusion, waved its trunk in the air, and, the moment he spoke, reared up on its hind legs, turned short round, and, with a shrill, passionate cry, rushed after him, bearing down the opposing reeds in his way, while Lieutenant Arlett vainly attempted to effect his escape. For a short time he had hopes of eluding his pursuer, as the animal perceived one of the seamen mounted on the top of a tree, about twenty feet high, and three in circumference, menacing him by his voice and gestures while preparing to fire. The elephant turned short round, and, shrieking with rage, made a kind of spring against the tree, as if to reach the object of his attack, when his ponderous weight brought the whole to the ground, but, fortunately, without hurting the man, who slipped among the reeds. The ferocious animal still followed him, foaming with rage, to the rising bank of the river, the man crying loudly, "An elephant! an elephant!" until, closely pressed by his pursuer, both the man and the elephant came upon the top of the slope, where the party, who had heard his cries, were prepared, and instantly fired a volley as the elephant appeared. This made him return with increased fury to Arlett, who, in his eagerness to escape, stumbled and fell—the huge beast running over him, and severely bruising his ankle.

As soon as he had passed, Arlett arose, and limping with pain, attempted once more to retreat, but the animal returned to the attack; his trunk was flourished in the air, and the next moment the unfortunate officer was struck senseless to the ground. On recovering himself, his situation appeared hopeless, his huge antagonist standing over him, chafing and screaming with rage, pounding the earth with his feet, and ploughing it with his tusks. When the party first saw them, Arlett was lying between the elephant's legs, and had it been the intention of the animal to destroy him, placing a foot on his senseless body would, in a moment, have crushed him to atoms; but it is probable that his object was only to punish and alarm, not to kill—such conjecture being perfectly in accordance with the character of this noble but revengeful beast.

Lieutenant Moodie, in his amusing "Ten Years in South Africa," gives the following account of his elephant hunting :

Some months after forming my new settlement, I engaged a Hottentot to shoot elephants and buffaloes for me, on condition of receiving half of the profits. This man, who was called Jan Wildeman, was a most expert hunter, rarely failing to kill on the spot whatever he fired at. He was a complete wild man of the woods, and had as many wiles as a fox in escaping the dangers to which he was daily exposed. His activity was most extraordinary ; and I was often surprised at his nimbleness in climbing the highest trees to get at wild vines growing over their tops. While I was considering how I could get up, he would take hold of one of the "baboon's ropes," as they are called, which hang in festoons from the branches, and, in a few seconds, he would be perched like a crow on the top, enjoying my surprise, and flinging down whole bunches of the fruit. Though naturally timid, he had acquired, by long practice, such entire confidence in the correctness of his aim, that he would go right up to an elephant in the woods, and bring him down with the first shot. Sometimes, however, his gun would miss fire, when he would betake himself to his heels, and, by his agility, never failed to effect his escape.

"Where'll We Run?"

Wildeman came to inform me, one evening, that he had shot three elephants and a buffalo ; and that there was a young elephant still remaining with the body of its dead mother, which he thought might be caught and brought home alive. There happened to be two friends with me from the district of Albany, who had never seen an elephant, and whom, therefore, I persuaded to accompany me.

As soon as we had finished our breakfast, we set off, accompanied by Jan Wildeman, my Hottentot, Speulman, and their wives, to assist in cutting up the buffalo, and carrying the flesh home. Entering the forest, Jan first brought us to the carcass of the buffalo. He next led us to one of the elephants he had killed, and showed us the place whence he had fired. The ball had entered the shoulder in the slanting direction, and passed through the heart. This was an exceedingly difficult shot, as he required to be very near to hit the right place, for the ball to penetrate through such a mass of skin and flesh.

After following several of the paths made by these animals and struggling through the tangled mazes of the forest, we ascended a steep, sandy ridge, covered with low bushes, near the shore, and, on reaching the top, we came in sight of the carcass of another of the elephants, and the young one standing by it. A few paces from it, we saw a large elephant

browsing among the low bushes. He smelt us as soon as we appeared on the top of the hill; and throwing up his trunk, and spreading his huge ears, uttered a most discordant cry. "Gownatsi!" ejaculated Jan Wildeman, "that's the rascal that gave me so much trouble yesterday; he's as cunning as the devil." The dogs instantly assailed the animal, and, after several ineffectual attempts to seize them with his trunk, he made off. The dogs now attacked the young elephant, and chased him up the steep, sandy hill where we were standing. My visitors, who were unaccustomed to large game, were exceedingly agitated. They had brought a gun with them, for form's sake, but had neglected to load it. One of them, who was a Scotsman, seized me by the coat, and cried out, in great agony—"Eh, man! whaur'll we rin?—whaur'll we rin?" It was no use telling him that there was not any danger, for he still kept fast hold of me, saying, "What! nae danger, man, and the beest comin' right up amang us? I say, man, what'll we do? Whaur'll we rin?" The women instinctively ran and squatted behind the bushes.

The Game Escapes.

As soon as I could break loose from the grasp of my countryman, I ran to endeavor to seize the young elephant by the trunk, and Speulman took his stand on the opposite side for the same purpose. I was astonished at the nimbleness with which the animal ascended the steep hill. As he approached the spot where we stood, we found he was much older than we expected, and, after making an ineffectual attempt to get hold of his trunk, we were obliged to give him a free passage between us. I now picked up my gun, and gave chase to him; but he ran so fast that I could not overtake him.

I was well pleased we had not succeeded in seizing him, as, in all probability, he would have done us some serious injury with his tusks, which were just appearing at the root of the trunk. When they are only a few days old, there is no difficulty in catching them, and they become docile almost immediately.

Elephants are still numerous in the interior, and are killed both by the Kaffirs and the Boers. The elephant hunt seems to have peculiar fascination for the latter—men and boys, from the age of fourteen to seventy, following the exciting sport. An Englishman, however, is said to bear away the palm as the most fearless hunter; for, during one year, he remained in the Veldt without cover for nearly three months, accompanied by two half-caste servants. These three are said to have killed, during that period, seventy elephants, the tusks of which weighed three thousand pounds! Ivory is exported by these Boers in large quantities; those of

Zautpansberg alone, in the short space of three months, having brought sixty thousand pounds, Dutch weight, or nearly thirty tons.

A Miraculous Escape.

William Charles Baldwin, in his book on "African Hunting from Natal to the Zambesi," relates two very thrilling adventures with elephants. He says: Meeting upon one occasion five bull elephants, I gave chase, singled and drove out the largest, and gave him a couple of pills to make him quiet; he shortly turned and stood at bay, about forty yards off, and then came on with a terrific charge. My newly purchased horse, Kebon, which I was riding for the first time, stood stock still, and I intended to give the elephant my favorite shot in the chest, but at every attempt to raise the gun for the purpose of so doing my horse commenced tossing his head up and down, and entirely prevented me from taking aim. During my attempts to pacify and steady him, the bull charged, and I fired at random, and whether the ball whistled uncomfortably near the horse's ear or not I can't say, but he gave his head so sudden a jerk as to throw the near rein over on the off-side; the curb-chain came undone, and the bit turned right round in his mouth.

The huge monster was less than twenty yards off, ears erected like two enormous fans, and trumpeting furiously. Having no command whatever of my horse, I dug the long rowels in most savagely, when Kebon sprang straight forward for the brute, and I thought it was all up; I leaned over on the off-side as far as possible, and his trunk was within a few feet of me as I shot close by him. I plied the rowels, and was brought again to a sudden stand by three mapani-trees, in a sort of triangle; a vigorous dig, and he got through, my right shoulder coming so violently in contact with one of the trees as almost to unhorse me, slewing my right arm behind my back, over my left hip. I know not how I managed to stick to my gun, 14 lbs. weight, with my middle finger only hooked through the trigger-guard, my left hand right across my chest, holding by the end of the reins, which, most fortunately I had in my hand when I fired, and in this fashion we went at a tearing gallop through a thick tangled bush and underwood, mostly hack-thorns, over which my nag jumped like a buck.

He was very nearly on his head three or four times, as the soil was very heavy, sandy, and full of holes. The monster was all this time close in my wake; at length I got clear from him, and he turned and made off in the opposite direction at his best pace. As soon as I could pull up, which I managed after performing three or four circles, I jumped off, righted my bridle, and went after him like the wind, as he had a long start, and I was

afraid of losing him in thick bush. After giving him ten shots, and sustaining three more savage charges, the last a long and silent one, far from

BALDWIN CHASED BY AN ELEPHANT.



pleasant, as my horse had all the puff taken out of him, and he could only manage to hold his own before the brute, to my great satisfaction he at length fell, to rise no more.

The other incident is as follows: We found a troop of eleven or twelve bull elephants in a thick hack-thorn bush on the banks of the river. As they crashed away I rode hard in the rear, shouting lustily, and singled out the largest bull. I rode close under his stern, and he cleared a path for me. He turned to see who had the audacity to ride so near, for the horse's nose touched him, when I gave him a bullet behind the shoulder, and cleared out of his path. In reloading I lost him, and, cantering on his spoor, he very nearly caught me, as he had stopped and turned round just where the path turned suddenly and sharply to the right, and I was almost under his very trunk ere I saw him.

Running for Dear Life.

He was lying in wait, and made a terrific charge, trumpeting furiously; the horse whirled like a top, and away I went, with both rowels deep in his flanks as I threw myself on his neck. It was a very near shave; his trunk was over the horse's hind-quarters. I went through bush that, in cold blood, I should have pronounced impenetrable, but did not come off scatheless; my poor hands were shockingly torn, and my trowsers, from the knee, literally in shreds, though made of goatskin. After giving the elephant two more bullets I lost him. The dogs were frightened to death, and would not leave the horse's heels.

I shortly came across another troop of bulls, which started off against the wind, leaving such a dust behind them that I was half smothered. I went, at last, a little wide of them, on the weather-side, and was able to get a view of their tusks, and I rode out one with beautiful long tusks. He very soon lessened his speed, turned, and before I was aware, charged me. I could not turn in time, and, therefore, fired right between his eyes. The shot struck him about an inch above the left eye, and brought him on one knee, and I was able to get out of his way. He then took up a position in the bush, and I loaded and gave him two more bullets in the head, one in the centre of his forehead.

He kept backing farther and farther into the bush, with his two enormous ears erected like fans, and, as I was thinking the last shot must tell on him, he made the longest and most furious charge I ever saw; he fairly hunted me, while I was half loaded, clear away. I rode in a circle to endeavor to dodge him, and at length succeeded. He stopped at last, and I began to reload. I had none but conical balls, and the gun was foul. I could not get one down. I sought in vain for a stone, and at length, in despair, took up a thick branch, and, what with hammering the ramrod, and driving it against the trunk of a tree, I at length got the bullet home: but my elephant had made good use of his time and got away.

Rhinoceroses are found in the same regions of the Old World as those inhabited by the elephants; they live like them in the forests, and feed exclusively upon coarse herbage and the leafy twigs of trees and shrubs. They appear, as a general rule, to be peaceable animals, unless irritated; in this case they charge with great fury upon their enemy, holding the head down, so as to present the point of the horn toward him. They are generally hunted merely for the sake of sport, but the natives of the countries inhabited by them kill them for the flesh; walking sticks of great beauty are cut out of their thick hides, and their horns are worked into boxes and drinking-cups, to the latter of which the eastern nations attribute the power of detecting poison in any fluid put into them.

Gigantic Creature Clad in Armor.

The most celebrated is the Indian rhinoceros. Of this the head and neck are rather short; the eye is small and lateral, and the animal cannot see in front, more particularly when the horn is full-grown, as it stands in the way of vision. The body is about nine feet long and five feet high; in its structure it is peculiarly massive, heavy, and hog-like, and often weighs six thousand pounds. It has a single horn from two to three feet long. The skin is of an earth color, hard and thick, and often turns a musket bullet; its surface is rough, especially on the croup and down the fore-shoulders; its folds are very distinct, and resemble plate armor. It is almost wholly destitute of hair, except at the tip of the tail and on the margins of the ears. This species inhabits Hindostan, Siam, and Cochin China; shady and marshy places in the neighborhood of rivers being its chosen haunts. It is fond of wallowing in the mire somewhat in the manner of hogs. Its food consists of grass and branches of trees. The flesh is not unpalatable.

This powerful animal, living amid the tall, rank vegetation of the jungles of India, and especially along the marshy borders of the Ganges, the Burrampooter, and other great rivers, is commonly hunted with the aid of elephants. They are usually found in small herds of four to six, led on by the most powerful among the troop. Their first instinct is to fly from such an attack, but if hard pressed they rush upon the elephants and seek to thrust the nose beneath the belly and rip them up by a fierce toss of the horn. The elephants, however, avoid this movement, and turning the back, receive the shock in that quarter, usually with little damage. Often, however, the impetus of the rhinoceros precipitates the elephant in a headlong plunge to the ground, and finding this to succeed, he will repeat the operation several times in succession. Formerly it was found that the hide of the rhinoceros was impenetrable to ordinary

musket balls; they are now easily brought down by larger and harder bullets.

The Indian rhinoceros is that usually brought to Europe and America, and which we are familiar with in the manageries; it is also that which is best known in history. The Romans became acquainted with it toward the close of the republic, and Pompey introduced it into the circus. It also figured in the triumphal procession of Augustus with Cleopatra—the beautiful Queen of Egypt and the hoggish rhinoceros combining to swell the pomp of the victor! Representations of this animal also appear on various coins of this period, and in the mosaics of Rome.

Old Story of a Famous Fight.

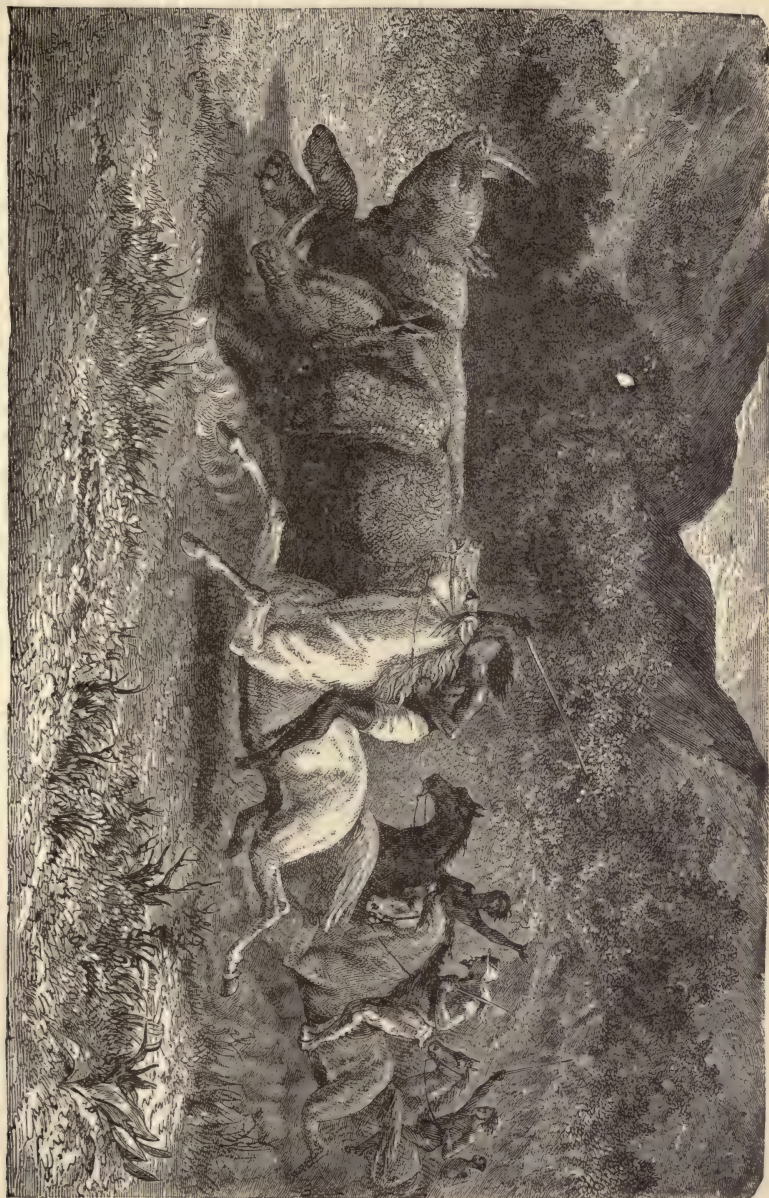
In the fanciful tales of the Arabian Nights a curious passage tells us that the rhinoceros fought with the elephant, pierced his belly with his horn, and carried him off on his head; but the fat and the blood filled his eyes and rendered him entirely blind, so that he fell prostrate on the earth. In this state of things a huge bird came and carried them both off to his young ones in his prodigious talons. It is curious to trace the threads of truth even in the wildest popular fiction: the manner of fighting here imputed to the rhinoceros is according to nature, and as to the roc—a bird as big as a village windmill—late discoveries have shown the bones of extinct species twelve or fourteen feet high, the traditions of which may well have been wrought into this gigantic feathered monster, which, the story says, flew away with both animals.

Both varieties of the African black rhinoceros are extremely fierce and dangerous, and rush headlong and unprovoked at any object which attracts their attention. They never attain much fat, and their flesh is tough, and not much esteemed by the Bechuanas. Their food consists almost entirely of the thorny branches of the wait-a-bit thorns. Their horns are much shorter than those of the other varieties, seldom exceeding eighteen inches in length. They are finely polished by constant rubbing against the trees. The skull is remarkably formed, its most striking feature being the tremendous, thick ossification in which it ends above the nostrils. It is on this mass that the horn is supported. The horns are not connected with the skull, being attached merely by the skin, and they may thus be separated from the head by means of a sharp knife. They are hard, and perfectly solid throughout, and are a fine material for various articles, such as drinking-cups, mallets for rifles, and handles for turners' tools. The horn is capable of a very high polish.

The eyes of the rhinoceros are small and sparkling, but do not readily

observe the hunter, provided he keep to leeward of them. The skin is extremely thick, and only to be penetrated with bullets hardened with

HUNTING THE AFRICAN RHINOCEROS.



solder. During the day, the rhinoceros will be found lying asleep, or standing indolently in some retired part of the forest, or under the base

of the mountains, sheltered from the power of the sun by some friendly grove of umbrella-topped mimosas. In the evening they commence their nightly ramble, and wander over a great extent of country. They usually visit the fountains between the hours of nine and twelve o'clock at night, and it is on these occasions that they may be most successfully hunted, and with the least danger.

Spasms of Uncontrollable Fury.

The black rhinoceros is subject to paroxysms of unprovoked fury, often plowing up the ground for several yards with its horn, and assaulting large bushes in the most violent manner. On these bushes they work for hours with their horns, at the same time snorting and blowing loudly; nor do they leave them in general until they have broken them into pieces. All the four varieties delight to roll and wallow in the mud, with which their rugged hides are generally encrusted. Both varieties of the black rhinoceros are much smaller and more active than the white, and are so swift that a horse with a rider on its back can rarely overtake them, yet they are often hunted with horses. Both attain an enormous size, being the animals next in magnitude to the elephant. They feed solely on grass, carry much fat, and their flesh is excellent, being preferable to beef. They are of a much milder and more inoffensive disposition than the black rhinoceros, rarely charging their pursuer. Their speed is very inferior to that of the other varieties, and a person well mounted can overtake and shoot them.

The description of the famous rhinoceros birds is very interesting. Before I could fire, says a well-known explorer, several "rhinoceros birds" by which he was attended warned him of his impending danger by sticking their bills into his ear, and uttering their harsh, grating cry. Thus aroused, he suddenly sprang to his feet, and crashed away through the jungle at a rapid trot, and I saw no more of him.

These rhinoceros birds are constant attendants upon the hippopotamus and the four varieties of rhinoceros, their object being to feed upon the ticks and other parasitic insects that swarm upon these animals. They are of a grayish color, and are nearly as large as a common thrush; their voice is very similar to that of a mistletoe thrush. Many a time have these ever-watchful birds disappointed me in my stalk, and tempted me to invoke an anathema upon their devoted heads. They are the best friends the rhinoceros has, and rarely fail to awaken him, even in his soundest nap. "Chukuroo" perfectly understands their warning, and, springing to his feet, he generally first looks about him in every direction, after which he invariably makes off.

If we examine the skull of a rhinoceros, we shall find that just under the place where the root of the horn lies, there is a peculiar development of the bone on which the weight of the horn rests. Now, it is well known that of all forms intended to support great weight, the arch is the strongest. Such, then, is the form of the bone which supports the horn; and in order to prevent the jar on the brain which would probably injure the animal when making violent strokes with the horn, one side of the arch is left unsupported by its pillar; so that the whole apparatus presents the appearance of a strong bony spring, which, although very powerful, would yield sufficiently on receiving a blow to guard the animal from the shock which would occur, were the horn to be placed directly on the skull. Such a structure as this is not needed in the case of the elephant, as that animal never strikes violently with its tusks, as the rhinoceros does with its horn.

That such is the intention of the structure is well shown by a curious circumstance that took place during a rhinoceros-hunt, and which shows that the animal can suffer severely from a blow on the horn, if that blow is given in a different method from that which the creature is in the habit of enduring.

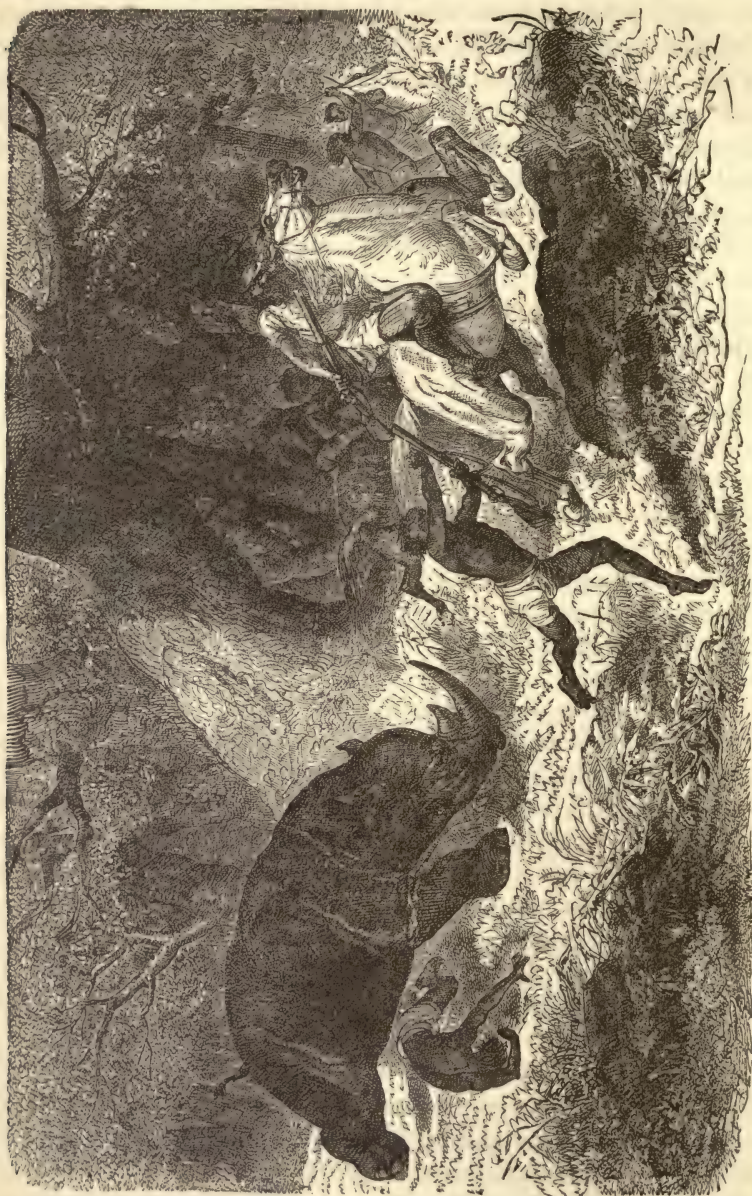
Some hunters were engaged in the pursuit of the rhinoceros, and had roused one of the animals from the thicket in which it was engaged in rubbing itself against the trees, after the usual fashion of the creature.

Method of Attack.

The skin, although thick, is very sensitive between the folds, and suffers much from the attacks of the mosquitoes and flies. The rhinoceros, to allay the irritation, rubs against trees, and has a curious custom of grunting loudly while performing this operation, and thus guides the hunter to its place of refuge. They are thus enabled to steal through the underwood unperceived, as the animal is too much engaged rubbing his sides to pay any attention to sounds which would at any other time send him off in alarm. By crawling along the ground, after the manner of serpents, they generally contrive to inflict a mortal wound before he is aware of their presence.

In the present case, the hunters were endeavoring to act in the same manner, but the intended victim became alarmed, broke through the wood, and made the best of his way towards a large cane-brake about two miles distant. The whole party pursued him, and the poor animal was speedily converted into a living pincushion, the place of the pins being supplied by spears.

The number and severity of the wounds appear to have confused his brain, for instead of keeping his straight course toward the canes, he



INFURIATED RHINOCEROS CHARGING ON HUNTERS.

turned off short, and dashed into a narrow gully without any exit. The ravine was so narrow that he broke to pieces many of the protruding

spears as he rushed in, and when he had fairly entered, there was barely room to turn. The assailants now had it all their own way, and one of them standing on the brink of the ravine took aim at his head, and stretched him on the ground apparently lifeless. All the hunters now jumped into the ravine, and set to work at cutting him up. But scarcely had they commenced when the animal recovered from his wound, and struggled upon his knees. Out went the hunters as fast as they could, and had it not been for the presence of mind of one of them, who hamstrung the rhinoceros before he ran away, in all probability several of the men would have forfeited their lives.

Curiosity induced the hunters to search for the wound that had thus stunned the animal, and they naturally expected to find the track of a ball through the brain, or, at all events, a wound on the skull; but after some search they found that the ball had only struck the point of the foremost horn, and had carried off about an inch of it.

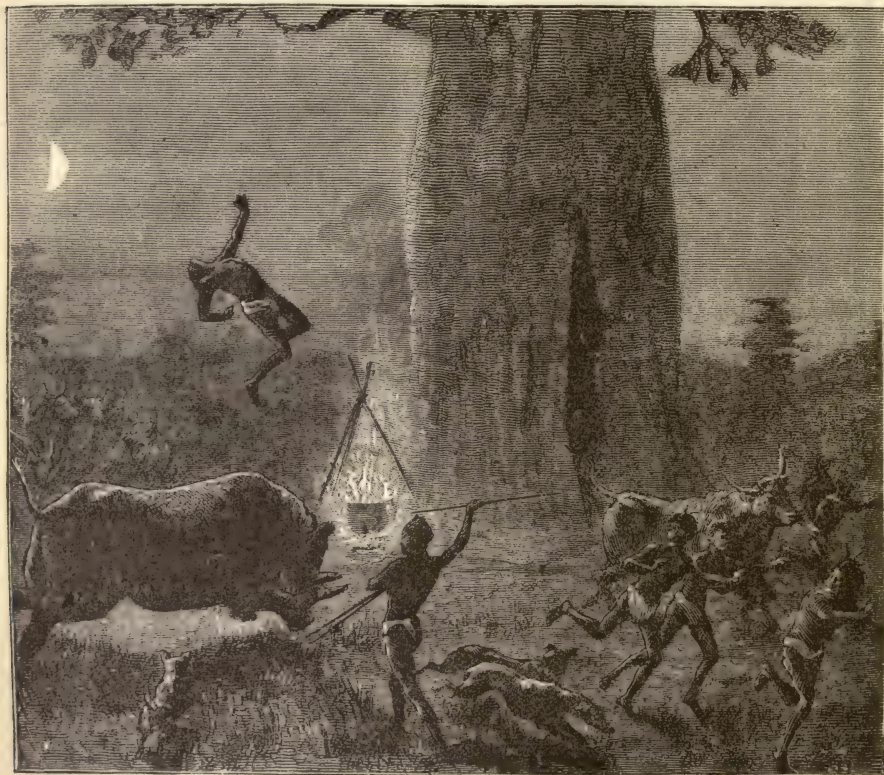
This is a very curious circumstance, because the blow was a comparatively slight one, and the shocks which the animal inflicts upon itself in the daily occurrences of life must be very severe indeed. But the whole structure of the head and horn is intended to resist heavy blows, while it is not capable of sustaining a sharp, smart shock without conveying the impression to the brain.

A Costly Boarder.

About a hundred and fifty years ago, one of these big beasts was brought to London from Bengal. He was a very costly animal; though only two years old five thousand dollars were expended in providing him with food and drink. Every day he ate seven pounds of rice mixed with three pounds of sugar, divided into three portions. He also ate plentifully of hay, but he much preferred fresh vegetables, grass, and herbs. He drank a great deal of water. He was so quiet and well-behaved, that he let people handle him, unless he was annoyed, or wanted his breakfast. The well-known specimen in the Zoological Gardens in London couldn't bear the noise of the roller used in keeping the gravel pathway in order which adjoined his den; his hearing was very quick, so that even while enjoying his dinner he stopped, and started aside, to listen.

Bingley gives the following account of a rhinoceros brought to England in 1790. It was then about five years old. It was somewhat tamed; it would walk about when desired to do so by its keeper; it would let visitors pat its back. Its daily allowance was twenty-eight pounds of clover, the same quantity of ship biscuit, and an enormous amount of greens. It was fond of sweet wines, and would drink four or five bottles in

a few hours. He made nothing of drinking fifteen pails of water in the course of a day. If he saw a person with fruit or any food that he was fond of, he would ask for a share, in a very pretty manner for so huge a beast, making a noise somewhat like the bleating of a calf. He died of inflammation, caused by slipping the joint of one of his fore legs. Some doctors made openings in his skin, in order to relieve his pain. These were always found quite healed up in the course of twenty-four hours.



CAMP ATTACKED BY "FIRE-EATING RHINOCEROS."

His death happened near Portsmouth, and the mayor ordered him to be buried on the common at Southsea. A fortnight afterwards some naturalists dug up the remains to preserve the skin and the most valuable of the bones, but the diggers were nearly overpowered by the stench of the body.

There is no doubt that the elephant and rhinoceros sometimes fight together madly, when they are in a wild state. Some years ago there was a specimen in the Regent's Park Gardens, that contrived to get into the

den of an old elephant there. They were afterwards the best friends in the world, and it was amusing to see how quiet the rhinoceros would stand whilst his great friend scrubbed his back with his trunk, and occasionally gratified himself by a sly pull at his tail, to make the rhinoceros turn his head, if his attention was taken off by visitors.

We have said that the horn is not fastened to the skull, but simply connected with his skin. It is not generally known that it can be removed by passing a sharp knife round its base. The skin is so strong and thick, that it can only be pierced by bullets of a peculiar make. The negroes of Africa know this perfectly well, and make it into shields and bucklers. His playful antics are somewhat useful; thus he will poke his horn into the ground, and then driving it along at a great rate, pushing with all his mighty force and strength, he will make a furrow broader and deeper than that of a plough. Those who have watched his habits tell us that he does this, not because he is in a passion, but in the pure enjoyment of health and spirits; just as when a little boy or girl, or dog or kitten, scampers about a lawn.

Some species of this animal are wild, and can be easily tamed; the powerful Indian rhinoceros is the shyest, and the double-horned the wildest. Mason, in his work, entitled "Burmah," remarked that the common single-horned rhinoceros is very abundant. The double-horned is not uncommon in the southern provinces; and then he alludes to the fire-eater of the Burmans, as distinguished from the common single-horned kind. The fire-eating rhinoceros, he tells us, is so called from its attacking the night fires of travellers, scattering the burning embers, and doing other mischief, being attracted by unusual noises, instead of fleeing from them as most wild animals do. Professor Oldham's camp-fire was attacked by a rhinoceros, which he fired at with a two-ounce ball; and three days afterwards the body was found, and proved to be of the two-horned species. The skull of that individual is now in the museum of Trinity College, Dublin. The commonest of the African rhinoceroses has been known to manifest the same propensity, and so has even the ordinary American tapir. In general, however, the Asiatic two-horned rhinoceros is an exceedingly shy and timid animal, and one of the largest size has been seen to run away from a single wild dog.

Shedding Horns and Getting New Ones.

The horns of a rhinoceros, consisting merely of agglutinated hairs, may, under rare circumstances, be shed in a mass, and subsequently renewed. A great one-horned rhinoceros living in the Zoological Garden at Moscow, did actually shed a horn, which is now in the museum of that city,

and another has since grown in its place. So the rudimentary frontal horn of the old female of the same species now in the London Zoological Gardens was roughly broken off on one occasion, and the blood flowed very profusely; but another hornlet has since been developed in its place, and there can now be no doubt that the same occasionally happens with wild animals.

Beautiful Appearance under the Microscope.

On a casual glance at a rhinoceros, the horn is the first object which strikes the eye. This projection is not a horn, but only a growth from the skin, and looks, when cut crossways, like a congeries of hairs; and if the hair be chafed towards its root, it will split up into innumerable filaments much resembling coarse horse-hair, and bearing a close similarity to the whalebone fringe of a whale's mouth.

Under the microscope a section of rhinoceros-horn presents a most beautiful appearance, and even this can be closely imitated by tying a tuft of hairs tightly together, soaking them in fine glue, suffering them to cool until they form a kind of rod, and then cutting a section like that of the rhinoceros-horn. If either of these preparations be examined with polarized light, the colors are gorgeous in the extreme.

Even in South Africa the horn of the rhinoceros is very valuable, as it can be cut into knobbed sticks which will stand almost any treatment without breaking. This property renders it especially useful for ramrods, as it is far stronger than wood, and possesses all the good properties of iron or steel without its weight or propensity to bend or break.

Savage Attack on Horses.

The power of the horn is terrific, and its efficacy has been found in several disastrous incidents. Both the African and Asiatic species are liable to sudden and unaccountable fits of anger, during which the animal will rush at any object that is near him, whether animate or inanimate, and dash it to pieces. One remarkable instance of this propensity took place at Dinapore. Some officers had gone down to the river for shooting, and had formed a small encampment by the river. Reports were rife of a neighboring rhinoceros; but they took no particular heed, for natives are seldom very truthful, and retired to rest with no fear of danger. One morning, just as they were about to rise, a great commotion was heard; and on running out to see what was the matter, they found that a rhinoceros was attacking their horses, and goring them violently. The poor horses being fastened, according to custom, were not able to resist or escape; while the natives, according to their custom, had all run away, and hidden themselves in a neighboring jungle.

There was, however, little blame to be attached to them ; for when the rhinoceros, after venting its rage on the animals, turned upon their mas-

CHARGE OF A RHINOCEROS SUDDENLY STOPPED.



ters, they, too, took to their heels, and thought themselves fortunate in finding a tree, up which they scrambled, and were for the present secure.

The rhinoceros, however, watched them for a long time, in hopes that they would descend; but on the rising of the sun, he slowly retreated into his haunts, every now and then casting an angry look over his shoulder. The brute was afterwards killed by a native hunter, who concealed himself near its hiding-place, and shot it with an iron ball from a jingall or matchlock, which carries a very large bullet, and is generally used by the natives for destroying the rhinoceros and other wild beasts. The hunter conceals himself near some place where he knows the animal will pass, and, resting his gun on the fork of a branch, he gets a steady aim, and is very seldom required to fire a second shot.

When the terrified gentlemen came down from their tree, they went to see what harm the rhinoceros had done, and found several of their horses fearfully gored. One poor animal was saddled at the time; and the horn of the rhinoceros had penetrated through saddle-flap and padding, fractured two ribs, and made an aperture through which a small hand might be passed into the horse's lungs.

Sometimes the rhinoceros attacks inanimate objects, such as bushes or trees, and assaults them in the most violent manner, not leaving them until he has broken them to pieces. Ploughing up the ground with the horn is also a favorite mode of expressing rage.

A Horse Saved by a Deadly Shot

One traveller relates that on one occasion he tied his horse to the limb of a tree, and in company with his native attendants went a short distance away, when he was horrified on returning to discover a huge rhinoceros in the very act of making a deadly charge upon the animal, and so near that the horse had already reared on his hind legs in the effort to escape. There was no time to be lost. The hunter raised his gun, took sure aim, and in an instant checked the onward rush of the enormous brute.

All rhinoceroses are fond of wallowing in mud, with which the body is not unfrequently encrusted, and their senses of hearing and smell are most acute, but not that of vision, so that they may be closely approached by keeping to leeward of them. On one occasion the wagon of a friend of Andersson was attacked by one of these animals: We heard shouting and firing, and on looking in the direction whence the noise proceeded, discovered to our horror, a rhinoceros rushing furiously at us at the top of his speed. Our only chance of escape was the wagon, into which we hurriedly flung ourselves. And it was high time that we should seek refuge, for the next instant the enraged beast struck his powerful horn into the bottom plank of the wagon with such force as to push the wagon several paces forward, although it was standing in very heavy sand. Most fortunately he

attacked the vehicle from behind; for if he had struck it at the side he could hardly have failed to upset it, ponderous as it was. From the wagon he made a rush at the fire, overturning the pot we had placed along side of it, and scattering the burning brands in every direction. Then, without doing any further damage, he proceeded on his wild career.

The flat-lipped or white rhinoceros (so called from its general pale color) is a very different animal from those of which we have been treating. It grows to more than six feet and a half high at the withers, where there is a sort of square hump, and its head has an exceedingly long anterior horn, attaining to more than four feet in length, whilst the hind horn is very short, not exceeding seven or eight inches. Its color is of such a light neutral gray, as to look nearly as white as the canvas covering of a wagon. Baines, describing a freshly-killed one, tells us that the skin was of a light pinky gray, deepening into a bluish neutral tint on parts of the head, neck, and legs. The limbs, shoulders, cheeks, and neck were marked with deep wrinkles. The mouth was very small, and the limbs were dwarfish compared with the bulk of the carcass. The eyes were small and set flat on the side of the head, with no prominence of brow, and in such a position as to discredit the assertion that the rhinoceros can see only what is straight before it. Chapman estimated the weight of one of these white rhinoceroses as being probably not less than 5000 pounds.

Timely Help for the Young Rhinoceros.

The male, he says, measures six feet eight inches at the withers, carries his head so low that his chin nearly sweeps the ground, is constantly swaying his head to the right and left when suspicious, and its calf, instead of going behind or at the side, always precedes the dam, and when fleeing is helped on by her horn or snout. The back of this animal is tolerably straight, the croup being as high, or even higher, than the withers. It moves each ear alternately backwards and forwards when excited, and the ears, when thrown forward, turn as if on a pivot so as to bring the orifice innermost. In the other African rhinoceroses the two ears are moved together, and not alternately. The ears are pointed or tufted.

This animal is of a comparatively mild and gentle disposition; and unless in defence of its young, or when hotly pursued, or wounded will very rarely attack a man. It is gregarious in families, the individuals comprising which are greatly attached to each other; and it utters a long sound, and not such a startling, whistling snort as do other species. It is an indolent creature, and becomes exceedingly fat by eating grass only.

The hippopotamus is exclusively an inhabitant of Africa, in many of the rivers of which it is tolerably abundant. It is a large animal, the males, according to some travellers, attaining a length of fourteen or fifteen feet. It feeds entirely upon vegetable substances, cropping the herbage and bushes on the banks of the rivers, and occasionally visiting the cultivated grounds during the night, when it does great damage. It passes most of its time in the water, where it swims and dives with great ease, and is said even to walk at the bottom. When the head of the animal is below the water it rises frequently to blow it out from its nostrils, making it ascend in two jets.

The Ferocious Hippopotamus.

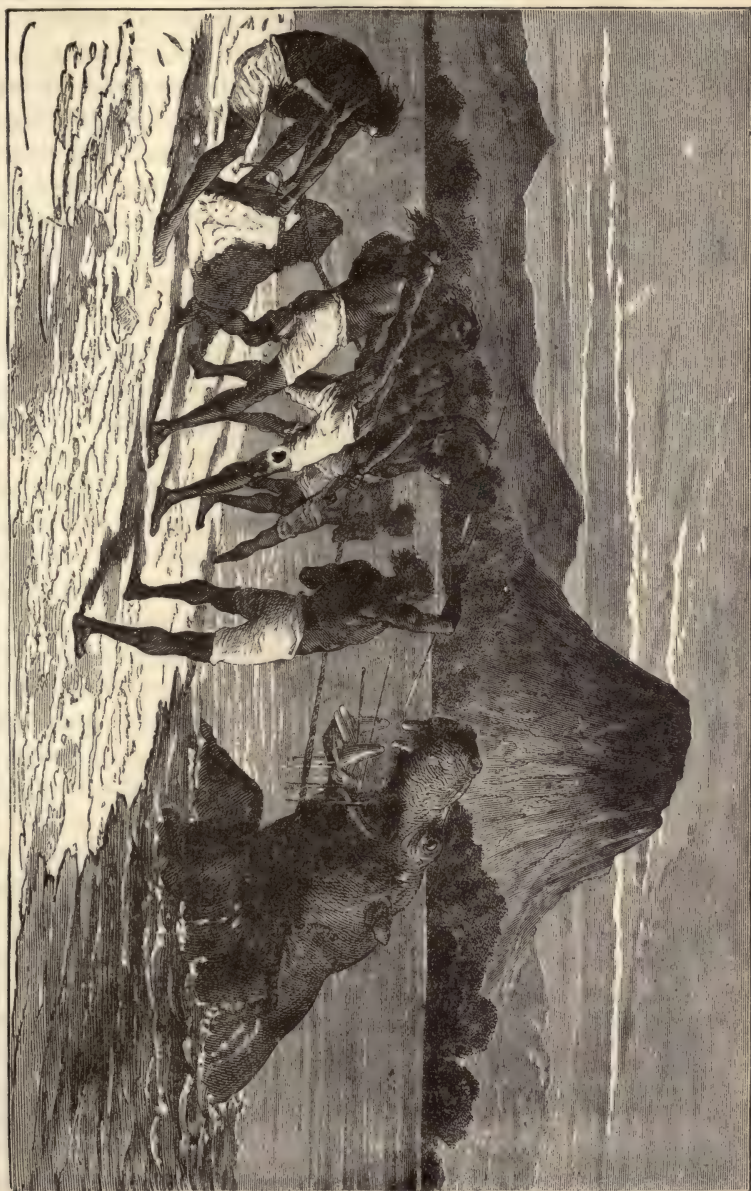
On shore, it trots heavily, but with considerable rapidity, and when two of them meet on solid ground they frequently fight ferociously, rearing up on their hind feet, and biting one another with great fury, so that, according to African travellers, it is rare to find a hippopotamus which has not some of his teeth broken, or the scars of wounds upon his body. When not irritated they appear to be quiet and inoffensive; but a very trifling irritation is sufficient to rouse their anger, when they attack the offender most furiously with their teeth; a hippopotamus which had been touched accidentally by a boat has turned upon it and torn out several of the planks, so that it was with difficulty the crew got to shore. A hippopotamus has also been known to kill some cattle which were tied up near his haunts, without the slightest provocation.

In Harris's "Sports of South Africa" we have the following accurate account of the habits of the hippopotamus: This animal abounds in the Limpopo, dividing the empire with its amphibious neighbor the crocodile. Throughout the night the unwieldy monsters might be heard snorting and blowing during their aquatic gambols, and we not unfrequently detected them in the act of sallying from their reed-grown coverts, to graze by the serene light of the moon; never, however, venturing to any distance from the river, the stronghold to which they betake themselves on the smallest alarm.

Occasionally, during the day, they were to be seen basking on the shore, amid ooze and mud; but shots were most constantly to be had at their uncouth heads, when protruded from the water to draw breath; and, if killed, the body rose to the surface. Vulnerable only behind the ear, however, or the eye, which is placed in a prominence, so as to resemble the garret window of a Dutch house, they require the perfection of rifle practice, and after a few shots become exceedingly shy, exhibiting the snout only, and as instantly withdrawing it. The flesh is delicious, re-

sembling pork in flavor, and abounding in fat, which in the colony is deservedly esteemed the greatest of delicacies. The hide is upward of an

CAPTURING A MONSTROUS HIPPOPOTAMUS.



inch and a half in thickness, and being scarcely flexible, may be dragged from the ribs in strips like the planks from the ship's side.

Cumming says that the track of the hippopotamus may be distinguished from any other animal by a line of unbroken herbage which is left between the marks of the feet of each side, as the width of the space between the right and left legs causes the animal to place its feet so considerably apart as to make a distinct double track. It may be remarked that the hippopotamus, as well indeed as the elephant and rhinoceros, is fast disappearing in all the countries where it exists, before the incessant and destructive war made upon it by fire-arms. It could resist, and for ages did resist, the rude and ineffective weapons of savages and barbarians, living and multiplying in spite of them; but the species must soon yield to the destructive propensity and power of civilized men.

At Close Quarters with a Hippopotamus.

After seeing the animal plunging about in his bath, diving with ease, and traversing the bottom of the tank as if it were dry land, one can the better appreciate the difficulties attending a struggle such as is related by Cumming in the following lines:

There were four of them, three cows and an old bull. They stood in the middle of the river, and, although alarmed, did not appear aware of the extent of the impending danger.

I took the sea-cow next me, and with my first ball I gave her a mortal wound, knocking loose a great plate on the top of her skull. She at once commenced plunging round and round, and occasionally remained still, sitting for a few moments on the same spot. On hearing the report of my rifle, two of the others took up stream, and the fourth dashed down the river. They rolled along like oxen, at a smart pace, as long as the water was shallow. I was now in a state of very great anxiety about my wounded sea-cow, for I feared she would get down into deep water, and be lost, like the last one. Her struggles were still bearing her down stream, and the water was becoming deeper. To settle the matter, I accordingly fired another shot from the bank, which, entering the roof of her skull, passed out through her eye. She then kept continually splashing round and round in a circle in the middle of the river. I had great fears of the crocodiles, and I did not know that the sea-cow might not attack me; my anxiety to secure her, however, overcame all hesitation. So divesting myself of my leathers, and armed with a sharp knife, I dashed into the river, which at first took me up to my arm-pits, but in the middle was shallower.

A Struggle to Get Ashore.

As I approached Behemoth, her eye looked very wicked at me, but she was stunned, and did not know what she was doing; so, running in

upon her, and seizing her short tail, I attempted to incline her course to land. It was extraordinary what enormous strength she still had in the water; I could not guide her in the least, and she continued to splash, and plunge, and blow, and make her circular course, carrying me along with her as if I was a fly on her tail.

Finding her tail gave me but a poor hold, as the only means of securing my prey, I took out my knife, and cutting two deep parallel incisions through the skin on her rump, and lifting this skin from the flesh, so that I could get in my two hands, I made use of this as a handle, and after some desperate hard work, sometimes pushing, sometimes pulling, the sea-cow continuing her circular course all the time, and I holding on her rump like grim death, eventually I succeeded in bringing this gigantic and most powerful animal to the bank. Here the Bushman quickly brought me a stout buffalo-rhein from my horse's neck, which I passed through the opening in the thick skin, and moored Behemoth to a tree. I then took my rifle, and sent a shot through her head, and she was numbered with the dead.

Slippery Caudal Appendage.

In explanation of one part of this description, the difficulty experienced by Mr. Cumming in holding by her tail will be easily understood by those who have examined the member in question. The tail of the hippopotamus is a flattened, naked affair, about two feet long, as thick as a man's wrist, and slightly fringed at the extremity with a few long bristles. If we imagine this tail flung about in the death-agony of a full-grown hippopotamus, it will not be difficult to conceive the almost impossibility of holding on by the hands, especially in the water, which is the natural element of the brute.

Lander relates a thrilling experience that befell some of his companions on one of their explorations. A hippopotamus happened to rise under their boat, and struck her back against its keel. Irritated by the unexpected resistance, she dashed at the boat with open jaws, seized the side between her teeth, and tore out seven planks. She then sank for a few seconds, but immediately resumed the attack, and if one of the crew had not fired a musket in her face, would probably have worked still more harm. As it was, too much mischief had been already done, for the loss of so much planking had caused the boat to fill rapidly, and it was only by severe exertion that the crew succeeded in getting the boat to shore before it sank. The boat was providentially not more than an oar's length from the bank when the attack took place; but had it been in the centre of the river, few, if any of the crew, would have escaped to tell the tale.

The shock from beneath was so violent, that the steersman was thrown completely out of the boat into the water, but was seized and drawn in again before the hippopotamus could get at him.

Taylor, the author of "A Journey to Central Africa," gives the following interesting narrative :

On the same day I saw the first hippopotamus. The men discerned him about a quarter of a mile off, as he came up to breathe, and called my attention to him. Our vessel was run towards him, and the sailors shouted, to draw his attention : " How is your wife, old boy ? Is your son married yet ? " and other like exclamations. They insisted upon it, that his curiosity would be excited by this means, and he would allow us to approach. I saw him at last within a hundred yards, but only the enormous head, which was more than three feet in breadth across the ears. He raised it with a tremendous snort, opening his huge mouth at the same time, and I thought I had never seen a more frightful-looking monster. He came up in our wake, after we had passed, and followed us for some time.

Directly afterwards we spied five crocodiles on a sand-bank ; one of them was of a grayish-yellow color, and upwards of twenty feet in length. We approached quietly to within a few yards of them, when my men raised their poles and shouted. The beasts started from their sleep, and dashed quickly into the water, the big yellow one striking so violently against our hull, that I am sure he went off with a headache.

Adventure with a Gorilla.

Sports in the tropics are not confined exclusively to four-footed beasts. There are creatures strongly resembling man which are sought by the natives, and sometimes are systematically hunted, as would be a tiger or an elephant. The equatorial coast of Africa has furnished a gigantic kind of man-like ape, which affords a curious confirmation of an old classic story.

Somewhere about the sixth century before the Christian era, one Hanno is reported to have sailed from Carthage, through the Pillars of Hercules, on a voyage of exploration along the coast of Africa. In the record of this voyage there occurs the following passage :—" Passing the Streams of Fire, we came to a bay called the Horn of the South. In the recess there was an island like the first, having a lake, and in this there was another island full of wild men. But much the greater part of them were women, with hairy bodies, whom the interpreters called ' Gorillas.' But pursuing them, we were not able to take the men ; they all escaped, being able to climb the precipices ; and defended themselves with pieces

of rock. But three women, who bit and scratched those who led them, were not willing to follow. However, having killed them, we flayed them, and conveyed the skins to Carthage; for we did not sail any further, as provisions began to fail."

The "wild men" of the ancient navigator were doubtless identical with the great anthropoid ape lately re-discovered, to which, in allusion to the old story, the name of gorilla has been given. The region in question is a richly wooded country, extending about a thousand miles along the coast from the Gulf of Guinea southward; and as the gorilla is not found beyond these limits, so we may conclusively infer that the extreme point of Hanno was somewhere in this region.

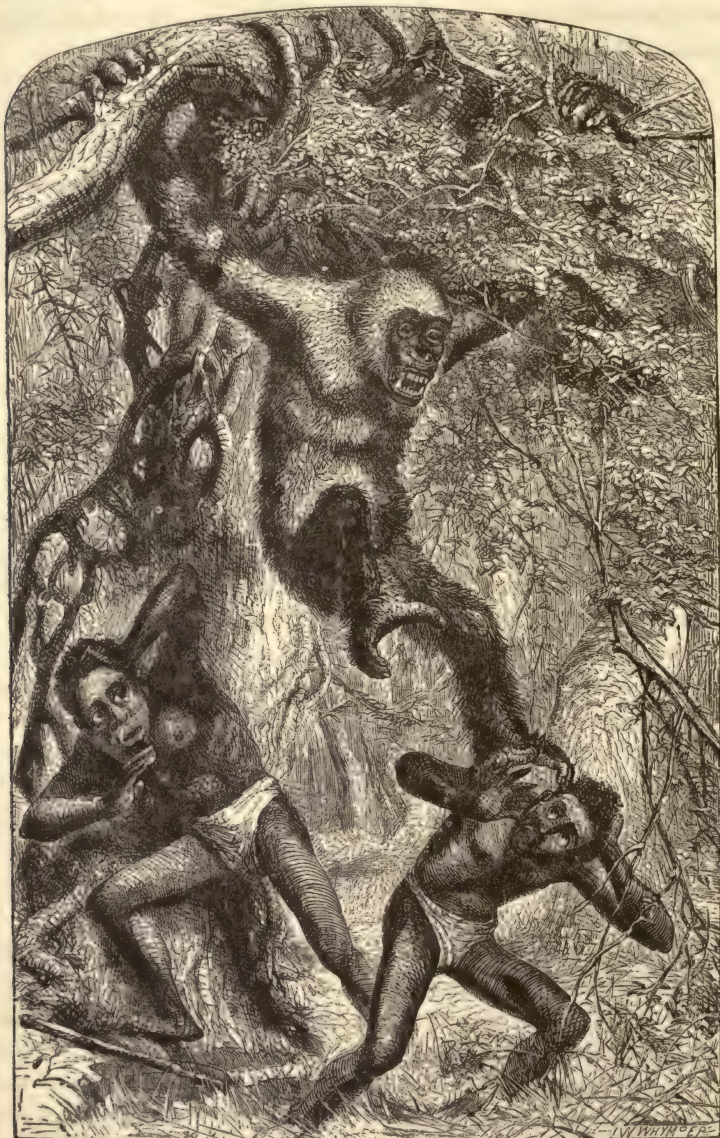
Savage Rival of Man.

This great ape makes the nearest approach of any brute-animal to the human form; it is fully equal to man in stature, but immensely more broad and muscular; while its strength is colossal. Though exclusively a fruit eater, it is described as always manifesting an enraged enmity towards man; and no negro, even if furnished with fire arms, will enter alone into conflict with an adult male gorilla. He is said to be more than a match for the lion.

The rivalry between the mighty ape and the elephant is curious, and leads to somewhat comic results. The old male is always armed with a stout stick when on the scout, and knows how to use it. The elephant has no intentional evil thoughts toward the gorilla, but unfortunately they love the same sorts of fruit. When the ape sees the elephant busy with his trunk among the twigs, he instantly regards it as an infraction of the laws of property; and, dropping quietly down to the bough, he suddenly brings his club smartly down on the sensitive finger of the elephant's proboscis, and drives off the alarmed animal trumpeting shrilly with rage and pain.

The young athletic negroes, in their ivory hunts, well know the prowess of the gorilla. He does not, like the lion, sullenly retreat on seeing them, but swings himself rapidly down to the lower branches, courting the conflict, and clutches at the foremost of his enemies. The hideous aspect of his visage, his green eyes with their glaring fire, his open mouth and fierce-looking teeth, the savage hand-like claws which form the end of his lower extremities, all render him an object of terror. When he is pursued, as he is sometimes by daring natives who are his natural enemies, he will defend himself with the utmost courage, and has been known to attack his foes with indescribable fury. Our engraving represents a combat between a gorilla and his pursuers. The description

is given by a traveller who heard the story of the adventure from the lips of the natives, after they had barely escaped with their lives. Gorilla hunt-



GORILLA TURNING UPON HIS PURSUERS.

ing is dangerous business, yet there are those who, for the sake of the excitement, engage in it, taking at times fearful risks.

In the barren wastes of Africa, and also of Asia, the traveller, as he journeys wearily onward, meeting with but stunted herbage and no water, sees from afar something that alarms him. It looks like a body of horsemen scouring the desert, and, as he fears, bent on plunder. There is no way of escape, and as he looks hither and thither the dreaded object approaches. Then his heart beats more freely, and his spirits revive. The band of horsemen, as he supposed it to be, turns out to be birds. And he is not the first traveller by any means who has made the mistake, and imagined the ostrich to be a man on horsback.

In the first place, the ostrich is quite as tall, and as he runs swiftly along there is nothing at a distance that he more resembles. He always feeds in a flock, and the barren wastes have been his home from time immemorial. He eats grass, and grain when he can get it, and does not seem to care for water. There are people who have said that the ostrich never drinks.

Breakfast of Stones and Leather.

However that may be, his appetite is the most curious part of him. He will swallow almost anything he can pick up, and you might wonder where he did pick up the things that have been found in his stomach, were it not for the caravans that now and then come across the desert. Pieces of leather, nails, lumps of brass or iron, to say nothing of stones, all go down his throat with ease.

He has a huge crop, and then a great strong gizzard. And besides these, he has a cavity that might be called a third stomach. So he is well provided. Of course, strong as his digestion may be, he cannot digest either nails or stones; and some people explain this by saying that his great crop wants so much to fill it, that he is obliged to put in all he can get. And others say that the stones and brass and leather help him to digest his other food, in the same way that grit or gravel helps our poultry at home.

The next curious thing about the ostrich is the pair of wings that nature has given him. The wing is nature's machine by which the bird can support itself in the air, and dart or sail through it as we may see every day. But in some birds the wing fails of this purpose, and is of no use at all to fly with. There are two reasons why the wings of the ostrich cannot bear him into the air. They are very small to begin with, and his great body is too heavy to be raised by any such means. And besides, the feathers of the wings are different from those of other birds.

Look how firm and compact is the wing of the swallow or the rook. The feathers fit close together, and the little plumes on each feather hook

into each other by those exquisite little catches that are among the marvels of nature. If you pass your finger over the wing it feels like one smooth surface. But in the wing of the ostrich the little plumes are loose, and float lightly about. The ostrich does not use his wings to fly with, though he spreads them out as he runs.

The Flying Camel.

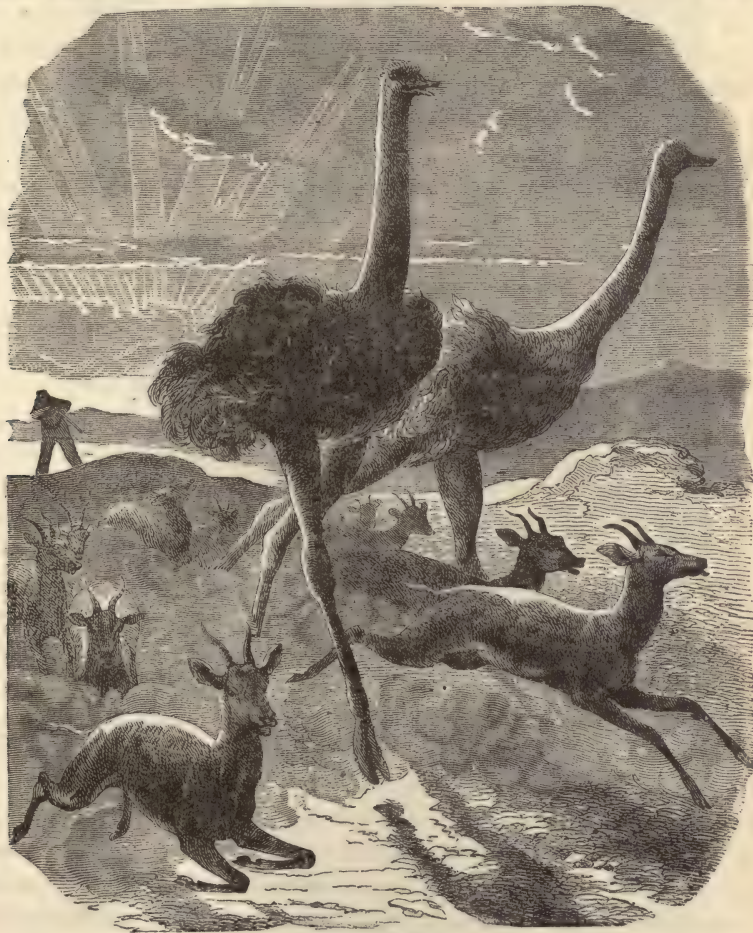
He is in many respects so like an animal, that he forms almost a link between the animals and the birds. Indeed he is so like the camel that he is called the camel-bird. His foot resembles the hoof of the camel. It has only two toes, and both point forward; and the first is longer than the second, and ends in a thick hoof-like claw. And the habits of the ostrich resemble those of the camel; they both live in the sandy desert, and are able to go a very long time without drinking. The ostrich does not make any nest, but merely scoops out a hole in the sand. When the proper season comes, the mother ostrich begins to lay her eggs; she lays about a dozen, and they are very large, and of a dirty white color. In the day-time she leaves them under the burning rays of the sun; but when night comes, and the air is cooler, she broods over them.

The natives of the country go out looking for the eggs of the ostrich. One monster egg has in it as much as thirty of our hen's eggs, and is considered a great dainty. But they are very careful how they set about the task of robbing the nest. They choose the time when the mother ostrich is away, and then they take a long stick and push the eggs out of the hole. If they touched any of them with their fingers, the ostrich would find it out in a minute, and go into a great rage. She would break all the eggs that were left with her hoof-like feet, and never lay in that place again. Sometimes a number of mother ostriches will lay their eggs in the same nest.

In some parts of Africa there are tribes of men who eat ostriches, not from gluttony, but because they can get very little else. They keep them as we do cattle, and make them quite tame. The ostrich is by nature gentle, though it is so large, and soon makes himself contented near the dwelling of his master. Sometimes his master rides upon him, and takes a journey.

The beautiful feathers of the ostrich are so admired, that great pains and trouble are taken to procure them. The Arab comes with his swift horse in search of the ostriches. A flock of them are quietly feeding together on the plain. If it is mid-day, they strut about, flapping their wings as if for coolness. When they perceive the enemy they begin to run, at first gently, for he keeps at a distance, and does not wish to alarm

them more than he can help. The wings of the bird keep working like two sails, and he gets over the ground so fast that he would soon be out of sight if he ran in a straight line. But he is so foolish as to keep running from one side to the other. The hunter, meanwhile, rides straight on, and when his horse is exhausted, another hunter takes up the game,



HUNTING THE OSTRICH.

and so on, allowing the poor bird no rest. Sometimes, in a fit of despair, he hides his head in the sand.

Another method adopted by the ostrich hunter is to disguise himself in the skin of one of these birds, and, armed with his bow and poisoned arrows, stalk about the plain imitating the gait and motions of the ostrich. Moffat thus describes a hunt of this kind:

A kind of flat double cushion is stuffed with straw and formed something like a saddle. All except the under part of this is covered over



AN EXCITING CHASE.

with feathers, attached to small pegs, and made so as to resemble the bird. The head and neck of an ostrich are stuffed and a rod introduced, and the Bushman intending to attack game whitens his legs with any sub-

stance he can get. He places the feathered saddle on his shoulders, takes the bottom part of the neck in his right hand, and his bow and poisoned arrows in his left. Such as the writer has seen were most perfect mimics of the ostrich, and at a few hundred yards' distance it is not possible for the eye to detect the fraud. This *human* bird appears to be picking away at the verdure, turning the head as if keeping a sharp lookout; shakes his feathers, now walks and then trots, till he gets within bow-shot, and when the flock runs from one receiving an arrow he runs too. The male ostriches will, on some occasions, give chase to the strange bird, when he tries to elude them in a way to prevent them catching his scent; for when once they do the spell is broken. Should one happen to get too near in pursuit, he has only to run to windward, or throw off his saddle, to avoid a stroke from a wing that would lay him prostrate.

The Arabs of North Africa pursue the ostrich on horseback; not at a dash, however—one exciting run and victory decided—but in a deliberate and business-like way. A flock having been sighted, the Arabs put their steeds in motion, and hold them at sufficient speed to keep in sight the fluttering army in advance. When the evening comes, the Arab pickets his horse and rests for the night, and his tired game, finding it is no longer pursued, sinks to the earth and rests too. Next morning the chase is commenced, the clicking of hoofs rouses the still weary bird, and once more he braces his limbs and pursues his hopeless flight. So the game continues, till, tired to death, and with drooping and bedraggled wings, the poor ostrich comes to a dead halt, and the gallant Arab hunter safely approaches and cuts its throat.

The Blow that Ends the Chase.

Toward the approach of the rainy season, when the days are intolerably hot and sultry, the ostrich may easily be ridden down by a single horseman. At the above-mentioned period the protracted drought tells even on this invulnerable bird, and he may be seen standing in a stupefied manner with his wings outspread and his beak wide open. Under such circumstances he offers but little resistance, and though for a few moments he may make hard running, his speed is not enduring; and presently he is again stock-still and stupidly agape, waiting for the hunter to knock him on the head with his "shambok," or knobby stick.

Our illustration depicts a chase of an ostrich described by Baldwin. Andersson relates that in certain parts of Southern Africa the ostrich is run down on foot. "I have myself seen the Bushmen accomplish this exploit on the shores of Lake Ngami. They usually surround a whole troop, and with shouts and yells chase the terrified birds into the water,

where they are, of course, speedily killed." Harris, on one occasion, fell in with a party of caravans chasing an ostrich on foot, and, when they got close enough, "shying" after the fleeing bird, their clubs striking the bird's legs and eventually laming him. "When the ostrich is slain," says the last-mentioned authority, "the throat is opened and a ligature passed below the incision. Several hunters then raise the bird by the head and feet, and shake and drag him about until they obtain from the aperture nearly twenty pounds of a substance of mingled blood and fat, of the consistence of coagulated oil, which under the name of 'manteque' is employed in the preparation of dishes and the cure of various maladies."

Some African tribes take the ostrich in snares, similar to those used in the capture of the smaller species of antelope. A long cord having at the end a noose is tied to a sapling, which is bent down, and the noose pinned to the ground in such a manner that when a bird treads within it the sapling springs back by its own natural elasticity, suspending the bird in the air, only to be released from its sufferings by death. Others again are said to employ ostrich feather parasols, or rather massy plumes—such as adorn our hearses—while hunting wild animals of every description. Thus in case of a wounded beast charging a man, the latter, just at the moment he is about to be seized, whips the big plume off his head, and thrusting the spike to which the feathers are bound into the ground, slips off. While the furious animal vents his rage on the nodding feathers, the wild hunter steals to its rear and transfixes it with his weapon.

Fair Play and no Favor.

In hunting the ostrich the mode most favored by sportsmen is to lie in wait at the margins of pools and springs where the birds come to drink. They swallow the water deliberately, and by a succession of gulps. While staying at Elephant Fountain, Andersson shot eight within a very short period. "Lying in wait," however, and taking advantage of your game from behind a wall or hedge, is by no means as a rule a favorite system with the hunter. If an animal has "fight" in it, nothing gives the true sportsman greater pleasure than for it to demonstrate the same to the fullest extent—sharp steel against talons just as sharp and terrible, swift bullets against swift and sudden springs and bounds and death-dealing fangs. Should the animal chased be dependent on its fleetness for safety, again the true sportsman would meet it with its own weapons, and stake bit and spur on the issue of the chase.

Andersson relates the particulars of a chase after young ostriches by himself and a friend, and which is none the less interesting that it bears witness to the tender solicitude of the ostrich for its progeny. "While on

the road between the Bay and Scheppmansdorf we discovered a male and female ostrich, with a brood of young ones about the size of ordinary barn-door fowls. This was a sight we had long been looking for, as Galton had been requested by Professor Owen to procure a few craniums of the young of this bird. Accordingly we dismounted from our oxen and gave chase, which proved of no ordinary interest.

Cunning Dodge to Save the Little Ones.

The moment the parent-birds became aware of our intention they set off at full speed, the female leading the way, the young following in her wake, and the male, though at some little distance, bringing up the rear of the family party. It was very touching to observe the anxiety the old birds evinced for the safety of their young. Finding that we were quickly gaining upon them, the male at once slackened his pace and diverged somewhat from his course; but seeing that we were not to be diverted from our purpose, he again increased his speed, and with wings drooping so as almost to touch the ground he hovered round us, now in wide circles and then decreasing the circumference till he came almost within pistol shot, when he threw himself abruptly on the ground and struggled desperately to regain his legs, as it appeared, like a bird that is badly wounded.

Having previously fired at him several times, I really thought he was disabled, and made quickly toward him; but this was only a dodge on his part; for on my nearer approach he slowly arose, and began to run in an opposite direction to that of the female, which by this time was considerably ahead with her charge. After about an hour's severe chase, however, we secured nine of the brood, and though it consisted of about double that number, we found it necessary to be contented with what we had bagged.



CHAPTER XI.

SIGHTS IN THE WORLD'S MENAGERIE.

Man in the Jaws of the Lion—Meeting the Great Beast—Death from the Stroke of a Paw—Jacob Bok's Adventure—Lion's Gratitude—Magnanimity of the King of Beasts—Shaking Mane and Lashing Tail—Tremendous Strength—Narrative of Brehm—Spectral Lemur—A Creature with Singular Eyes and Claws—Fine Tree-Climbers—The Babiroussa—Quadruple Tusks—A Restless and Ferocious Beast—White-Lipped Peccary—Plucky Fighters—Wart-Hog—A Dangerous Brute—Invader of Cultivated Fields—Expert Swimmer—Adventure of Captain Harris—The Lithe Panther—Supple Muscles of Great Strength—Sudden Spring—Thirst for Blood—Doctor Brehm's Remarkable Experience—An Old Dog-faced Baboon—Dreadful Encounter—Courage of a Malay Captain—The Tapir—An Omnivorous Quadruped—Cousin of the Hippopotamus—A Fortunate Nose—Whistling Tapirs—Tapir Domesticated—The Wallachian Sheep—Extraordinary Horns—Splendid Growth of Wool—Mountain Sheep of Bokhara—Horns of Surprising Size—A Dwelling on High Rocks—Flying Fox—Marvelous Membrane—Unique Product of the Animal Kingdom—Hanging from Forest Branches—Arctic Seals—Elegant Fur—Hunting the Seal—Sea-Elephant—The Walrus—Use of Tusks—Perils of Walrus Hunting.



At the present day lions are only found in Africa and Asia. Nor are they any longer to be seen in the Holy Land, though they are often alluded to in the Bible. It is a tawny animal, and is very strong. The African lion is different from the Asiatic, and the African lions themselves seem to consist of four or five kinds. It was formerly believed that they had prickles in their tails, which rendered them wilder and more furious when they lashed their sides. They are not often found in forests; they seem to like best the shelter of the low common that creeps along the sides of streams. The powerful brute sometimes carries off men.

A Cape lion has been known to seize a heifer in his mouth, and though the legs dragged upon the ground, he carried her off easily. Another conveyed a horse about a mile from the spot where he had killed it. Another, that had carried off a two-year old heifer, was followed on the spoor, or track, for five hours by horsemen, when it was found that throughout the long distance the heifer had touched the ground only once or twice. To avoid these blood-thirsty beasts, whole villages are sometimes built in the upper branches of trees. The African lion generally lives upon cows, calves, antelopes, and animals of this description.

Burchell, the traveller, gives an interesting account of his meeting one of these great beasts: The day was exceedingly pleasant, and there was not a cloud to be seen. For a mile or two we travelled along by the banks of the river, which in this part abounded in tall matrushes. The dogs seemed much to enjoy prowling about, and examining every bushy place, and at last met with some object among the bushes which caused them to set up a most vehement and determined barking. We explored the spot with caution, as we well knew, from the peculiar tone of their bark, that it was what we expected it to be—lions.

Having desired the dogs to drive them out, a task which they performed with great willingness, we had a full view of an enormous black-maned lion and lioness. The latter was seen only for a minute, as she made her escape up the river under the concealment of the rushes; but the lion came steadily forward, and stood still to look at us. At this minute we felt our situation not free from danger, as the animal seemed preparing to spring upon us, and we were standing on the bank, at the distance of only a few yards, most of us being on foot and unarmed, without any visible opportunity of escaping. I had given up my horse to the hunters, and was on foot myself; but there was no time for fear, and it was useless to attempt avoiding him. I stood well upon my guard, holding my pistols in my hands with my finger upon the trigger; and those who had muskets kept themselves prepared in the same manner. But at this instant the dogs flew boldly in between us and the lion, and surrounding him, kept him at bay by their violent and resolute barking.

Facing the Monarch of the Forest.

The courage of those faithful dogs was most admirable; they advanced up to the side of the huge beast, and stood making the greatest clamor in his face, without the least appearance of fear. The lion, conscious of his strength, remained unmoved at their noisy attempts, and kept his head turned towards us. At one moment the dogs, perceiving his eye thus engaged, had advanced close to his feet, and seemed as if they would actually seize hold of him; but they paid dearly for their imprudence, for, without discomposing the majestic and steady attitude in which he stood fixed, he merely moved his paw, and at the next instant I beheld two lying dead. In doing this, he made so little exertion, that it was scarcely perceptible by what means they had been killed. Of the time which we gained by the interference of the dogs not a minute was lost. We fired upon him; one of the balls went through his side, just between the short ribs, and the blood began to flow, but the animal still remained standing in the same position. We had now no doubt that he



A HERD OF CATTLE ATTACKED BY AN IMMENSE AFRICAN LION.

would spring upon us ; every gun was instantly re-loaded ; but, happily, we were mistaken, and were not sorry to see him move quietly away, though I had hoped in a few minutes to have been enabled to take hold of his paw without danger.

Even where the hunter has been seized with a panic and pursued, a timely recovery of self-possession has saved him. Sparrman relates that Jacob Bok, of Yee-koe-river, one day walking over his land with his loaded gun, unexpectedly met a lion. Being an excellent shot, he thought himself pretty certain, from the position he was in, of killing it, and therefore fired his piece. Unfortunately he did not recollect that the charge had been in it for some time, and therefore was damp, so that his piece hung fire, and the ball falling short, entered the ground close to the lion.

In consequence of this he was seized with a panic, and took directly to his heels ; but being soon out of breath, and closely pursued by the lion, he jumped up on a little heap of stones and there made a stand, presenting the butt-end of his gun to his adversary, fully resolved to defend his life as well as he could to the utmost. This deportment had such an effect upon his pursuer, that he also made a stand, and lay down at the distance of a few paces from the heap of stones, seemingly quite unconcerned. Jacob, in the meantime, did not stir from the spot ; besides, he had in his flight unfortunately dropped his powder-horn. At length, after waiting a good half-hour, the lion rose up, and at first went very slowly, and step by step only, as if he had a mind to steal off ; but as soon as he got to a greater distance, he began to bound away at a rapid rate.

Story of a Rescued Slave.

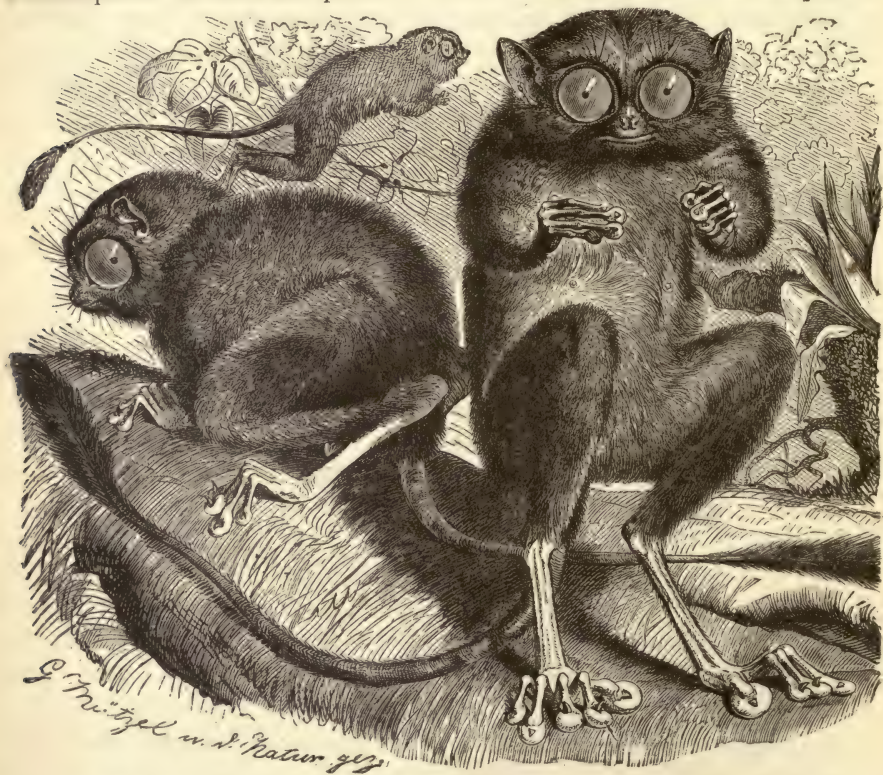
In old books of Natural History, there is a story about a slave, called by some Androcles, and others, as for instance Gellius, Androdus, who cured the foot of a lion, which had been dangerously wounded by a splinter. Some years afterwards, the lion was caught, and taken to the great circus at Rome, to form part of a show of wild beasts. One day the slave, perhaps for some great crime, was driven into the circus, to be devoured by the lions. His old friend immediately recognised him, and defended him with rare zeal and tenderness. The slave was liberated, and owed his life to the good memory of the wild beast.

Unless provoked, or very hungry, the lion does not attack any animal openly ; but when roused by famine, he is said to fear no danger, and to be repelled by no resistance. Generally the lion takes his prey by springing or throwing himself upon it with one vast bound from the place of his concealment. Should he miss his leap, he will not follow his prey ; but as though he were ashamed, turning around towards the place where

he lay in ambush, he slowly, and step by step, measures the exact length between the two points, as if to find how much too short he had taken his leap.

The lion is said to be a great coward or at least deficient in courage proportionate to his great strength.

There have been instances where the lion deviated from his mode of attack of springing upon his prey. He has often been seen to despise contemptible enemies and pardon their insults, when it was in his power



AN ODDITY OF THE ANIMAL KINGDOM—SPECTRAL LEMUR.

to have punished them. He has been known to spare the lives of such creatures as were thrown into his cage to be devoured by him, to live peaceably with him, to afford them part of his sustenance, and sometimes even to want food himself rather than deprive them of the life which his generosity had spared.

The lion is commonly said to devour as much at once as will serve him for two or three days, and in captivity he is usually allowed four pounds of raw flesh for his daily subsistence. His jaws are so powerful that he

can break the bones of animals with ease, and he often swallows them along with the flesh. His tongue is furnished with reversed prickles so large and strong as to be capable of lacerating the skin.

When he is enraged or in want of food, he erects and shakes his mane, and beats his tail against his back and sides. While he is in this state, it is certain death to any person who happens to approach him. The lioness is smaller than her mate and destitute of a mane. The lion is a nocturnal animal; only when forced he leaves his lair during the day. Only after midnight he approaches the habitations of man. Espying a herd of cattle he will commence roaring for the purpose of putting the cattle to flight and then to capture a victim. Dr. Brehm asserts that once he was present when a lion, having killed a heifer two years old, jumped with the victim in his mouth over a thorn hedge nearly nine feet high and then dragged it to his lair.

The roaring of the lion in quest of prey resembles the sound of distant thunder, and being re-echoed by the rocks and mountains appals the whole race of animals, and puts them to a sudden flight.

The Asiatic variety of the lion is inferior to the African in size, strength and fierceness, with less ample mane, and with less width of head and nobleness of bearing.

The Spectral Lemur.

Lemur is the name applied to about thirty species of monkeys. They are divided into five principal genera, inhabiting chiefly Madagascar, a few living in Africa and the warm regions of Asia and its archipelago.

The animals have two sharp claws on each hind foot, all their other nails are flat. In their habits and economy, as well as in their hand-like paws, the lemurs are like the other monkeys. They principally differ from those animals in the shape of the head, which is somewhat like that of a dog, and in the great length of their hind legs. The latter are so long, that when the lemurs walk on all-fours, their haunches are considerably more elevated than the shoulders.

But this structure is of great advantage to them in climbing trees. Many of the species are so active that they leap from branch to branch with a rapidity which the eye is scarcely able to follow. The lemurs derive their name from their nocturnal habits and their noiseless movements. They live in the depths of the forests, and only move by night, the entire day being spent in sleep. Their food consists of fruits and insects which latter they take while they are sleeping.

The spectral lemur is of a grayish-brown color, and lives in the forests

of the Indian archipelago, its long tarsi, or hind-legs, enabling it to leap like a frog, and its curious eyes giving it a singular appearance.

The Dutch name of *babiroussa* means stag-hog. There is reason to think that the ancients were not altogether unacquainted with this animal. Pliny notices a wild boar with horns on the forehead, found in India; and Cosmos, a writer in the sixth century, uses the term hog-deer, as the designation of an Indian animal. However this may be, it is only recently that naturalists have become well acquainted with it and its habits, though skulls of these animals have been brought in abundance by vessels trading among the Moluccas.



PECCARY OR STAG-HOG.

The *babiroussa* differs somewhat in dentition from the hog, the incisors being four above instead of six, and the molars five on each side, in either jaw. The upper canines, or tusks, of the male emerge directly upwards from their apparently distorted sockets, and sweep with a bold arch backwards, attaining to a very great length. The skin is thick, coarse, of a blackish tint, and sparingly beset with very short, bristly hairs. The tusks of the lower jaw are long, strong, and sharp, emerging like those of the boar. The tusks of the upper jaw do not pass out between the lips, but cut their way through the skin, nearly half way between the end of the snout and the eyes. The tusks of the lower jaws are formidable

weapons. The male, when adult, equals the largest hog; the female is of much inferior size, and destitute of the curled upper tusks, or has them only rudimentary.

This animal is found in the marshy forests in the interior of Bourou, and other of the Molucca islands, as Amboyna, and also Java, where it associates in troops. Its habits resemble those of the wild hog, and it is restless and ferocious. According to Lesson, it feeds chiefly on maize, preferring that grain to other articles of diet. * It is partial to the water, and swims with the greatest ease, often crossing the straits between adjacent islands without any difficulty. In a state of captivity, as in the London Zoological Gardens, and the Paris Menagerie, this animal seems to be contented.

The White-Lipped Peccary.

The animals of this species congregate in numerous bands, sometimes, it is said, to more than a thousand individuals of all ages. Thus united, they frequently traverse extensive districts, the whole troop occupying an extent of a league in length, and directed in their march, if the accounts of the natives are to be credited, by a leader, who takes his station at the head of the foremost rank. Should they be impeded in their progress by a river, the chief stops for a moment, and then boldly plunges into the stream, and is followed by all the rest of the troop. The breadth of the river and the rapidity of the current appear to be but trifling obstacles in their way, and to be overcome with the greatest facility. On reaching the opposite bank, they proceed directly on their course, and continue their march through the plantations which, unfortunately for the owners, may happen to lie in their way, and which they sometimes completely devastate by rooting in the ground for maize, or potatoes, or devouring such fruit as they find there. If they meet with anything unusual in their way, they make a terrific clattering with their teeth, and stop and examine the object of their alarm. When they have ascertained that there is no danger, they continue their route without further delay; but if a huntsman should venture to attack them when they are thus assembled in large numbers, he is sure to be surrounded by multitudes and torn to pieces by their tusks, if he is so unwise as to neglect his only chance of escape, which consists in climbing a tree, and thus getting fairly out of their reach. The smaller bands are by no means equally courageous, and always take to flight at the first attack.

An Animal Hard to Conquer.

In Guiana, Sonnini was surrounded by a herd of peccaries, exasperated at the havoc made among them by the fusils of himself and his companions. Betaking himself to a tree, he beheld at his ease how they encour-

aged, by their grunts and by rubbing their snouts together, those that were wounded from the shots above, still maintaining their ground with bristles erect and eyes fiery with rage. They sometimes stood an incessant fusilade of two or three hours before they quitted the battle-field and left their dead to the conquerors. After such encounters comes the festival of the travellers. A great gridiron—so to speak—of sticks, fastened in the ground, and some three feet in height, with numerous small branches laid on it in a transverse direction, is got ready. On this sylvan cooking-appa-



ÆLIAN'S WART-HOG.

ratus the pieces of peccary pork are broiled over a slow fire kept up during the night. Sonnini dwells enthusiastically on these forest feasts.

The wart-hog is found in Africa from Abyssinia to the Guinea and Mozambique coasts. It is remarkable for possessing four tusks, two of which proceed from the upper jaw and do not pass out between the lips, but through an aperture in the skin, half way between the end of the snout and eyes. The sockets of the two upper tusks are curved upwards and give a singular appearance to the skull of the animal. It is very ferocious and cannot be hunted without danger.

When taken young it can be tamed without much difficulty, and conducts itself much after the manner of the pig. Only the male has the double pair of tusks, the female only possessing those belonging to the under jaw in a rudimentary degree. It lives in troops and thus does much damage to the cultivated grounds, especially of maize, of which it is very fond. It is a good swimmer and often takes to the water in order to cross a stream. It feeds on roots and bulbs, which it digs out of the ground, but also on worms, larvæ, and even carrion.

Leader of the Herd Finally Brought Down.

This species, sometimes called Ælian's wart-hog, was found first in Kordofan, but afterwards, in greater abundance, on the eastern slope of Abyssinia. It haunts low bushes and forests, and has a habit of creeping on its bent fore limbs in quest of food. In this attitude it uses its tusks in digging up or tearing out of the ground the roots or plants, which constitute part of its diet. When thus engaged, it pushes its body forward by means of its hind legs, in order to move along.

The capture of another species is thus described by Captain Harris: Returning one drizzly morning from the banks of the Limpopo, with the spoils of three noble water-bucks packed upon my horse, I chanced upon a very large drove of the unclean beasts, feeding unconcernedly on the slope of a hill; and the sleet obscuring my rifle sights, I shot no fewer than three bullets at the diabolical-looking boar without touching a bristle; the whole party, with a general grunt, scampering off after each discharge to a little distance, then wheeling about to show a menacing front, lifting their whip-lash tails at the same time, and screwing horrible faces at me. But the fourth missive tripped up the hoary general; and, although shooting a pig may sound somewhat oddly in the sporting ears of my brother Nimrods, I can assure them that whilst we had no horses to spare, "the head of that ilk swine" proved a prize well worth the lead and gunpowder that had been expended on it. Gigantic, and protruding like those of an elephant, the upper tusks were sufficiently hooked to admit of the wearer hanging himself up by them to roost, as did his ancestors of yore, if the ancients are to be believed. By all who saw these trophies in the colony, they were invariably taken for the ivories of a hippopotamus, the best that I afterwards saw measuring less than one-half their length.

The Muscular Panther

Is a large African spotted cat, considered by some naturalists as a variety of the leopard. If not distinct species the panther and leopard are very marked varieties. The former is more powerful, darker colored, with the



GREAT AFRICAN PANTHER AND CUBS.

markings arranged with considerable regularity and the tail longer in proportion. This is probably the animal so abundantly supplied to the public spectacles of ancient Rome, hundreds having been exhibited together.

It is an expert climber, very active and readily trained. The panther of South America is the jaguar. The length of the panther is usually more than six feet, exclusive of the tail, which is about three feet long. The color of the upper parts of the body is bright yellow with numerous black, roundish, or somewhat annular marks, several of which have in the centre of each a black spot. The under parts of the body are white.

The panther lurks in ambush amongst the bushes and springs with a sudden leap on passing animals. So prompt and rapid are its movements, that few escape. In vain may the victim seek for refuge even in the trees; the panther notwithstanding the size and weight of its body still pursues with almost incredible agility its victim and dispatches the same. It has none of the noble qualities of the lion.

A Bloodthirsty Creature.

The thirst for blood is insatiable, and its ferocity is such, that even when subjugated and in the power of man, it seems rather to be subdued than tamed. In the panther all the peculiarities of the cat family are combined; it is a beautiful animal, nimble, powerful, active, cunning, courageous, but also deceitful, shrewd, insidious, wild, revengeful and bloodthirsty.

Dr. Brehm relates a remarkable experience with a panther. He and his followers travelled one day through the Bogos mountains in Africa, when suddenly they heard the challenging barking of the dog-faced baboons; they resolved to try their rifles on them. Some of the shots missed, others hit their marks, and the victims either were killed outright or tried to escape. One old dog-faced baboon which had received a wound in the neck, came tottering down the rocks and turned towards the valley. They did not pay any further attention to this animal, expecting to find it dead in a short time, and fired several more shots at some of the other baboons.

Suddenly they noticed great excitement among the monkeys, and at the same time they heard a wild noise in the valley, while all the old male baboons came to the edge of the precipice, and looking down showed great anger and excitement. All at once a loud and furious barking of the dogs, which had remained in the valley with the pack mules was heard, and some of the men cried for help. Looking down, Dr. Brehm saw a panther running towards his men, but apparently employed with something else, which he could not discern on account of the body of the

animal hiding it. Then two shots were heard, and the panther disappeared.

Brehm hurried to the spot, and soon found in a dense bush the panther dead, and about ten feet from it the body of the old dog-faced baboon. It was apparent that the wounded baboon was, in spite of the shooting, while passing the place of concealment of the panther, attacked by this animal. It had jumped on the back of the baboon, and had been carried by it down to the spot where their lifeless bodies were found.

Remarkable Encounter with a Panther.

The following interesting particulars of an encounter with one of these animals are from the pen of a gentleman who witnessed it :

I was at Jaffna, at the northern extremity of the Island of Ceylon, when, one morning, my servant called me an hour or two before my usual time, with "Master, master! people sent for master's dogs—tiger in the town!" Now, my dogs chanced to be some very degenerate specimens of a fine species, called the Poligar dog, which I should designate as a sort of wiry-haired greyhound, without scent. I kept them to hunt jackals; but tigers are very different things. By the way, there are no real tigers in Ceylon; but leopards and panthers are always called so, by ourselves as well as by the natives. This turned out to be a panther. My gun chanced not to be put together; and, while my servant was doing it, the collector and two medical men, who had recently arrived, in consequence of the cholera-morbus having just then reached Ceylon from the Continent, came to my door, the former armed with a fowling-piece, and the two latter with remarkably blunt hog-spears. They insisted upon setting off, without waiting for my gun—a proceeding not much to my taste.

The tiger (I must continue to call him so) had taken refuge in a hut, the roof of which, like those of Ceylon huts in general, spread to the ground like an umbrella; the only aperture into it was a small door, about four feet high. The collector wanted to get the tiger out at once. I begged to wait for my gun; but no—the fowling-piece (loaded with ball, of course,) and the two hog-spears were quite enough. I got a hedge-stake, and awaited my fate, from very shame. At this moment, to my great delight, there arrived from the fort an English officer, two artillerymen, and a Malay captain; and a pretty figure we should have cut without them, as the event will show. I was now quite ready to attack, and my gun came a few minutes afterwards. The whole scene which follows took place within an enclosure, about twenty feet square, formed, on three sides, by a strong fence of palmyra leaves, and on the fourth by the hut.

At the door of this the two artillerymen planted themselves, and the Malay captain got at the top, to frighten the tiger out, by worrying it—an easy operation, as the huts there are covered with cocoa-nut leaves. One of the artillerymen wanted to go in to the tiger, but we would not suffer it. At last, the beast sprang. This man received him on his bayonet, which he thrust apparently down his throat, firing his piece at the same moment. The bayonet broke off short, leaving less than three inches on the musket; the rest remained in the animal, but was invisible to us. The shot went, probably, through his cheek, for it certainly did not seriously injure him, as he instantly rose upon his legs, with a loud roar, and placed his paws upon the soldier's breast. At this moment the animal appeared to me about to reach the centre of the man's face.

Thrown over the Wild Beast's Head.

I had just time to observe this when the tiger, stooping his head, seized the soldier's arm in his mouth, turned him half round, staggering, threw him over on his back, and fell upon him. Our dread now was that, if we fired upon the tiger, we might kill the man. For a moment there was a pause, when his comrade attacked the beast exactly in the same manner as the gallant fellow himself had done. He struck his bayonet into his head; the tiger rose at him—he fired; at this time the ball took effect, and in the head. The animal staggered backwards, and we all poured in our fire. He still kicked and writhed, when the gentleman with the hog-spears advanced, and fixed him, while he was finished by some natives beating him on the head with hedge-stakes.

The brave artilleryman was, after all, but slightly hurt. He claimed the skin which was very cheerfully given to him. There was, however, a cry among the natives, that the head should be cut off. It was; and in so doing the knife came directly across the bayonet. The animal measured little less than four feet, from the root of the tail to the muzzle. There was no tradition of a tiger having been in Jaffna before. Indeed this one must have either come a distance of almost twenty miles, or have swum across an arm of the sea nearly two in breadth; for Jaffna stands on a peninsula, with no jungle of any magnitude.

The Malay Tapir.

The tapir belongs to the genus of ungulate mammals having the nose prolonged into a short, movable proboscis. The tapirs look like hogs but the legs are longer. They inhabit the moist tropical forests of South America and of the Malayan peninsula and archipelago, usually sleeping by day in retired places and feeding at night on fruits, grapes and other vegetable substances, though they are as omniverous as the

hog. They are fond of rolling in the mud and water and are excellent swimmers.

In its habits the tapir has a considerable resemblance to the hippopotamus; yet in many particulars it reminds us also of the elephant and of the rhinoceros. Its skin is so thick and hard as to be almost impenetrable by a bullet. Although its natural disposition is indicative of mildness and timidity, yet if its retreat is cut off it has courage and strength to make a most powerful resistance, both against man and dog. In feeding



OMNIVEROUS MALAY TAPIR.

it uses its long projecting nose in the same manner as the rhinoceros applies its upper lip to grasp the food and convey it to the mouth.

This proboscis is an instrument of great flexibility and strength and in it, as in the trunk of the elephant, are situated the organs of smell. Notwithstanding its clumsy appearance the tapir is an exceedingly active animal in the water, where it swims and dives with great facility. Like the hippopotamus it is able to continue immersed for a considerable while, but it is forced to occasionally rise to the surface in order to breathe.

Its voice is a kind of a whistle, which the hunters easily imitate and by this means lure it to its destruction. When at rest the tapir usually sits on its haunches like a dog. Only during the pairing season the male lives in company of the female. To the latter belongs the whole duty of rearing their offspring. This she leads to the water and she seems to delight in teaching it to swim. If they are caught young the tapirs may without difficulty be tamed and rendered even in some degree domestic. The Malay tapir is somewhat larger and is known by the grayish-white color of the loins and hind quarters, which gives the animal an appearance as if covered with a white cloth; the other parts are deep black.

Enormous Strength and Fierce Disposition.

Few animals of equal size have so extensive a range as the American tapir. It is found in every part of South America to the east of the Andes, from the Straits of Magellan to the Isthmus of Darien; but it appears to be most common within the tropics. The inmost recesses of deep forests are the chosen haunts of this species, which is not gregarious, and flies from the proximity of man. Inoffensive and gentle, the tapir, from his prodigious strength and the toughness of his hide, is no easy prey to the native hunter, notwithstanding his poisoned arrows, nor even to the better armed sportsman of Europe. When attacked, the first thing it does is to rush to the river, clearing a path through the intertwined underwood by dint of muscular exertion. Here it often happens that neither men nor dogs can follow. If tracked to the water, it plunges in, and defends itself against its assailants, seizing the dogs with its teeth as they swim towards it, and inflicting on them the most desperate wounds.

The tapir is a most indiscriminate swallower of everything, filthy or clean, nutritious or otherwise, as the accumulation found in a stomach dissected by Yarrell showed. Pieces of wood, clay, pebbles, and bones, are not unfrequently taken out of the stomachs of those which are killed in the woods; and one kept by D'Azara not only gnawed a silver snuff-box to pieces, but swallowed its contents. The short proboscis of this creature, though incapable of being employed like the more complicated organ of the elephant, is yet manifestly of great use in enabling it, by serving as a hook, to pull down boughs or fruits, and to collect together and guide to its mouth roots, succulent plants, or other substances on which it feeds.

In some parts of South America the tapir is domesticated. Sonnini saw numerous individuals walking at liberty about the streets of Cayenne, whence they were accustomed to stroll into the neighboring woods, returning at night to their home; nor were they by any means destitute of



SPIRAL-HORNED WALLACHIAN SHEEP.

H. Schimper del.

intelligence, but seemed fond of their masters, whom they acknowledged by various tokens of attachment.

The Wallachian Sheep.

Few animals render greater and more essential services to mankind than the sheep. They supply us both with food and clothing, and the wool alone of the common sheep affords in some countries an astonishing source of industry and wealth. They came into northern and western Europe long after the goat. The domestic sheep presents a great variety of breeds; several of them have received distinct specific names. The most important breed of sheep as regards the texture of the wool is the merino, in modern times brought to the greatest perfection in Spain.

The wool ascending over the forehead and cheeks is fine, long, soft, twisted in silky spiral ringlets, and naturally so oily that the fleece looks dingy and unclean from the dust and dirt adhering to the outside, but is perfectly white underneath. Another species is the black-headed sheep with straight twisted horns, called the Wallachian sheep. It is very stupid, like its relatives in different parts of Europe, but at the same time vicious and unruly and of amazing strength.

Picturesque Head Ornaments.

Its horns are very large, spirally contorted, adding greatly to its striking and picturesque appearance. Its wool, if wool it can be called, differs materially in texture and quality from that of the common or the merino sheep. Instead of being curly and in silky ringlets, it is of great length, perfectly straight, and beautifully fine, falling from the middle of the back on either side of the animal almost to the ground. On the face the hair is short and rusty black, on the body it is white. The horns of the male mostly rise almost perpendicularly from the skull, making a series of spiral turns in their ascent, the first turn being the largest, while in the female they diverge, taking a lateral direction.

The Katskar or Mountain Sheep of Bokhara.

Lieutenant Wood, in his work, "Travels to the Source of the Oxus," says: After reaching an elevation of thirteen thousand five hundred feet, and in the neighborhood of the source of the Oxus, we saw many horns of sheep carelessly thrown about, apparently the result of the chase of the kirghiz. Some of these horns were surprisingly large, and belonged to an animal which seems to stand between the goat and the sheep, and which inhabits the steppes of Parnis in herds of many hundreds. The ends of these large horns stood out above the snow, and showed to us which road to follow. Wherever we found a greater number of them piled up we were sure to stand upon an old kirghiz summer-camping-ground.

In describing one of these animals, Lieutenant Wood says: It was a proud animal, as high as a two-years filly, with a venerable beard and two splendid horns, which, together with the head, were of such a great weight that it was difficult to lift it from the ground. The eviscerated body was a full load for a pony. The flesh was tough and bad, but is said to become more tender and better tasting in the fall. The full-grown katsh-



BOKHARA MOUNTAIN SHEEP.

kar is about six feet long, three to four feet high, and weighs about four hundred and sixty pounds.

In all probability this animal is not only found in Northern Thibet, but also on the table lands of Central Asia, always in rocky districts, where it seeks shelter from its pursuers, and never descends beyond the snow-line. Zewolski found during the winter herds of five to fifteen, even twenty-five to thirty. Each herd had two or three bucks, one of whom

had the lead and general direction. They place an unconditional confidence in the leader, and as soon as he starts to run the others follow him without hesitation. It is difficult to tell which is the more beautiful animal of the great plains of Thibet, the wild yak or the katshkar.

The Flying Fox.

This animal belongs to the family of bats, and is a mammiferous quadruped. The skeleton of the bats combines a great degree of lightness with peculiarities in the anterior extremities suitable for purposes of flight. The faculty of flight depends on an entirely different organization in the bird and in the bat. The principal part of the bat's flying membrane is stretched between the enormously elongated fingers, and from them reflected to the posterior extremities; while in the birds the parts which correspond with fingers are so rudimentary, that the hand can hardly be said to exist.

Bats have a very exalted sense of touch, which, as Cuvier discovered, resides in the flying membrane. This membrane arises from the skin of the flanks and consists of an abdominal and a dorsal leaflet twisted into an exceedingly thin and delicate network. It includes not only the arms and hands, but the hinder extremities, being prolonged between the legs and spread the length of the tail, forming a sensitive surface, entirely disproportionate to the size of the body.

Great Delicacy of Organization.

To increase its sensitiveness it is nearly, or wholly, destitute of hair. The bat is made acquainted with the distance of bodies by the different modifications impressed upon its membrane by the impulse of the air. The fur of bats is exceedingly fine and soft. They fly to a considerable height and with great rapidity. They are nocturnal; in the warm summer evenings they sally forth in search of prey; they pass the winter and indeed the most of the year in torpidity, without either food or motion, suspended in some dark place. During the time they remain in this state, most of the animal functions are suspended and scarcely perceptible. The action of the heart and arteries becomes so exceedingly languid, that the pulse can hardly be felt, and if respiration be at all carried on, it is also so very slow, as scarcely to be discernible. The animal heat sinks greatly below the usual standard and digestion becomes altogether suspended. None of the functions seem to go on, excepting a very slow degree of nutrition and an interchange of old for new matter in the depository cells of the body.

The female makes no nest for her offspring; she is content with the



WONDERFUL FLYING FOXES.

first hole she finds, where sticking herself by her hooks against the sides of her apartment she permits her young ones to cling to her. When she begins to grow hungry and finds it necessary to go abroad in search of food, she takes her little ones off and sticks them to the wall in the same manner that she had hung before. There they immovably cling, and patiently await her return.

Marvelous Membrane.

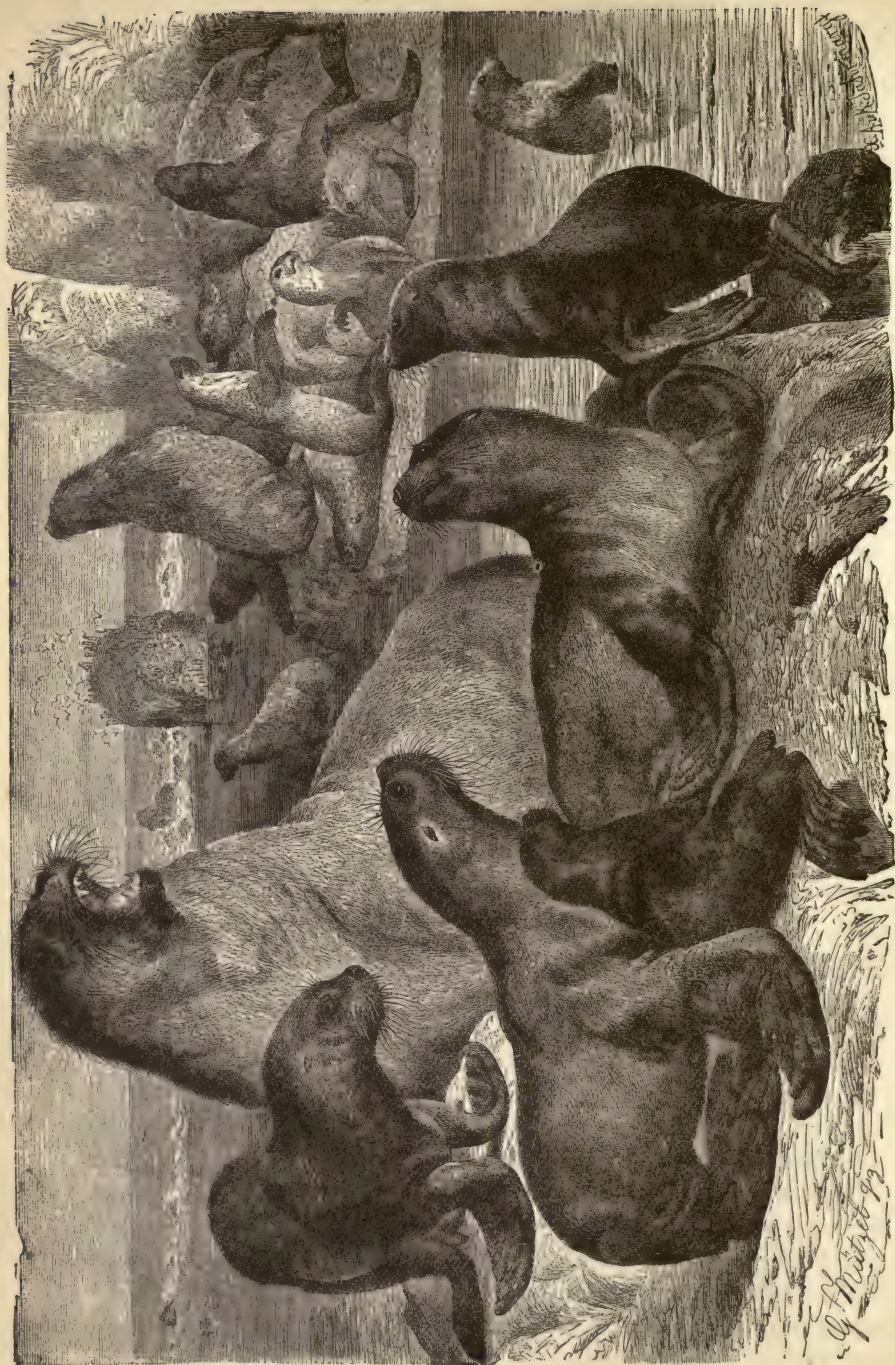
The flying fox is found from East India to Madagascar and inhabits forests and gardens in great numbers. It is gregarious and if possible rests during the day suspended heads-downward on the branches of shady trees. It is said that sometimes they attach themselves to the branches of trees in such a profuse number, that these branches are broken off by their weight.

The flying membrane, which they wrap around themselves, protects their eyes from the rays of the sun, but leaves space enough for breathing and hearing. Their sleep is continued as long as the sun shines, but is now and then temporarily interrupted by the animal, to clean and oil the membrane, which is done by touching and stretching every part of it by aid of the snout and tongue. This being done, the fox wraps itself up again in the membrane. They cannot be kept in captivity for a long period, because the flying exercise is essential to them. Boils break out on their flying membranes and death soon follows.

Remarkable Characteristics of Polar Seals.

The seal is an aquatic carnivorous mammal. Seals live chiefly in the Arctic and Antarctic Seas near the coast and often at the mouths of rivers, preying on fish, crustaceans and cephalopod mollusks. They are gregarious and migratory, fond of particular spots, leaving the colder arctic regions in winter for milder seas. The herds are usually of the same species and when different, each species keeps by itself, rarely fighting with the others. They are fond of crawling out of the water upon rocks, beaches and ice floes, always keeping a good lookout and plunging into the water at the approach of an enemy. In the breeding season they fight fiercely. Their bite is severe and the wounds made by their teeth will not heal readily either on their own, or the human body; some of the larger species are very powerful.

Their voice is a kind of a bark, not unlike that of a dog. They can remain under water twenty minutes and even longer and their animal heat is among the highest found in mammals. Their senses of smell and sight are very acute. They are easily tamed, affectionate and docile.



SEALS IN THEIR NATIVE HAUNTS.

Few animals are more tenacious of life than seals; the larger species are killed with a lance thrust into the heart, and the smaller ones are stunned by a blow on the nose from a long-handled hammer or bludgeon. The Esquimaux hunt them in light boats with lances, or spear them at holes in the ice where they come up to breathe; to them the seal supplies food, oil for light and warmth, skins for clothes, boots, utensils, tents and boats, sinews for thread, and lines and membranes for undergarments and window coverings. The oil is of superior quality, and if prepared from the fresh animals is transparent, free from odor, and not unpleasant of taste; the skin by a peculiar process of Esquimaux tanning makes a waterproof leather.

As articles of commerce seal skins are of two kinds, hair skins and fur skins; the former are used for making garments; the latter, now chiefly from Alaska, for finer purposes; all seal skins, however, have a mixture of coarse hairs and finer fur. The females produce two or more young ones at a birth. These, in northern climates, they deposit in cavities of the ice, and the male makes a hole through the ice near them for a speedy communication with the water. The manner in which the male seal make their holes is astonishing; neither their teeth nor their paws have any share in the operation; it is performed solely by their breath. When the females come out of the sea they bleat like sheep for their young, and though they often pass among hundreds of other young ones before they come to their own they will never make a mistake.

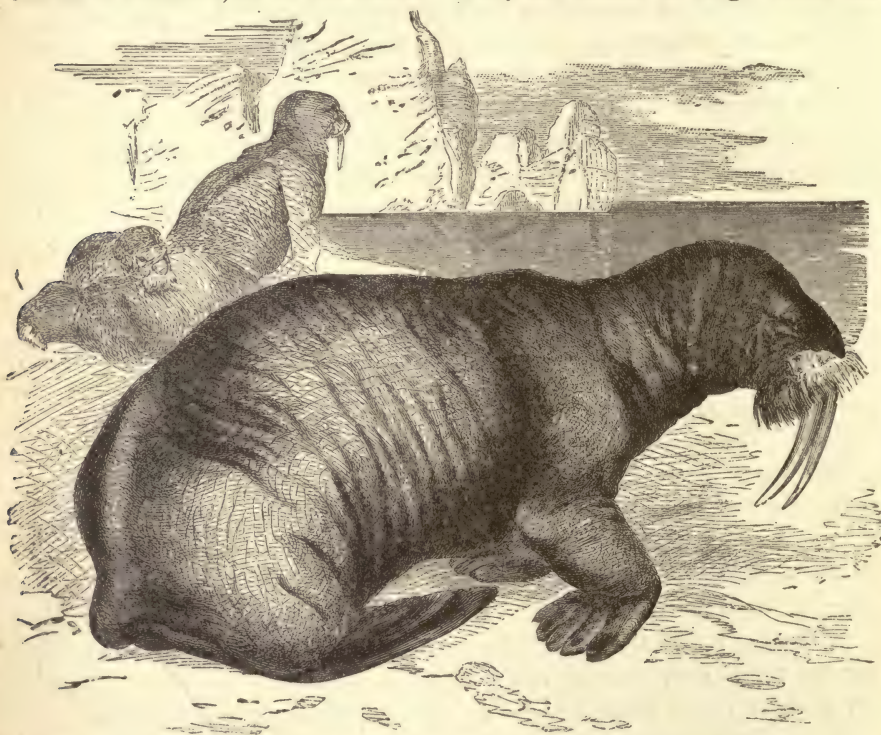
Unique Swimming School.

About a fortnight after their birth the young ones are taken out to sea and instructed in swimming and seeking their food, and when they are fatigued the parent is said to carry them on her back. It is said that their growth is so rapid that in fifty-four hours after their birth they become as active as their parents.

The common seal attains a length of four to six feet; the color varies much, but is generally brownish above and yellowish white below, variously mottled, and sometimes pied and marbled. The Greenland or harp seal is about six feet long; the males are grayish white, the females are brownish with blackish spots, and the young snow-white. They are found in herds on the coast of Greenland on floating ice, rarely venturing on shore or shore-ice. These are the most important of all to the Esquimaux, who harpoon them from their kaiaks. The oil is the best and most abundant in this species, and the skins form an important article in the fur trade.

The bottle-nosed seal or sea-elephant is the largest of the seal family,

attaining a length of twenty-five feet and more, with a circumference of sixteen feet, the size as well as the proboscis justifying this name. The males are generally dark grayish blue or brown, and can elongate the proboscis to a foot in length; the females are dark olive brown above and yellowish below, and do not have the nasal appendage. The hair is coarse, but the thick skin is in much request for harness leather. A single animal will yield fourteen to fifteen barrels of blubber from which the oil is obtained, as in the whale. They are found in large herds on



WALRUS OR SEA-HORSE.

the shores of the islands of the Antarctic Sea, going north in winter to the coast of Patagonia. This species is half as large as the Greenland whale, and very much larger than the largest elephant.

The walrus moose or sea-horse, is a marine arctic mammal, resembling the large seals. It attains a length of twelve to fifteen, sometimes twenty feet, a circumference of ten feet, and a weight of nearly a ton. The color is blackish in the young, brownish in the adult, and more and more white with age. The food consists almost entirely of the bivalve shells attached to the sea weeds, which it tears from the rocks, and

occasionally of fish. It is distributed in the arctic regions of both hemispheres, often confined to limited districts far removed from each other.

The capture of the walrus is more dangerous and less remunerative than that of the seal and is pursued both by land and sea. The tusks, which protrude downward from the upper jaw, afford a very white and hard ivory. The skin makes a porous leather more than an inch thick; the flesh is eaten by the Esquimaux and by arctic voyagers.

The uses to which the tusks are applied by the walrus are the scraping of prey out of the sand and to aid them in their ascent upon islands of ice, and as weapons of defence against the attacks of their enemies. When irritated these animals are sometimes very furious and vindictive. When surprised on the ice, the females first provide for the safety of their young ones by flinging them into the sea and conveying them to a secure place; they then return to the place where they were attacked to revenge any injury they may have received. They are strongly attached to each other and will make every effort in their power to liberate a harpooned companion.

Swift Revenge upon the Attacking Boat.


A wounded walrus has been known to sink beneath the surface of the ocean, rise suddenly again, and bring with it multitudes of others, which have united in an attack on the boat, from which the harpoon was thrown. Great numbers of walrus regularly visit the Magdalene Islands in the Gulf of St. Lawrence every spring. They crawl up the sloping rocks of the coast in multitudes and when the weather is fair, they remain for many days; but on the first appearance of rain, they retreat to the water. Formerly their herds have been known to amount to seven or eight thousand.

In the night the hunters endeavor, taking advantage of a sea wind, to prevent the animals from smelling them, to separate those which are farthest advanced from those nearest to the sea, driving them in different directions. When separated they are killed with leisure, those nearest to the shore becoming the first victims. It is said that as many as fifteen hundred walruses have been killed at one time. They are then skinned and the fat, that surrounded them, is taken off and rendered into oil. The skin is cut into slices two or three inches wide and exported for traces and glue. The animals frequently weigh from 1500 to 3000 pounds and yield from one to two barrels of oil each. The whale-tailed moose or manati, and the round-tailed manati, belong to the family of walrus. The avarice of man has greatly reduced the number of walruses and to-day a herd of several hundred is rarely seen.

CHAPTER XII.

FOUR-HANDED ANIMALS.

The Gorilla—Giant of the Forest—A Missionary's Explorations and Discoveries—Curiosity of Civilized Nations Awakened—Gorilla Huts—Low Order of Intelligence—Enormous Jaws and Physical Strength—The First White Man Who Killed a Gorilla—How Gorillas Bury their Dead—Thrilling Adventures of Du Chaillu—A Savage Combat—The Orang-Outang—Man-like Ape—Awkward Motions—Great Power of Mimicry—Dreaded Adversary—Laughable Tricks—Orang of the Prince of Orange—Escape from the Cage—Brute Gentleness and Affection—An Orang on Shipboard—Inveterate Tippler—Ravenous Thieves—Orang's Death—Guereza Monkey—Elegant Decoration—Beauty of Color—Monkey Grimaces—Droll Antics—Proboscis Monkey—Ample Dimensions of Nose—Dog-Faced Baboon—Immense Troops—Prowlers and Plunderers—A Chaplain's Story—Chased by Baboons—Lion Monkey—Irritable Creatures—Hairy Appendages.

F the size and form of the gorilla, Professor Owen remarks, "no other idea of its nature than that of a kind of human being would be suggested; but the climbing faculty, the hairy body, and the skinning of the dead specimens, strongly suggest that they were great apes. The fact that apes, the closest observed resemblance to the negro, with human stature, and with hairy bodies, still exist on the west coast of Africa, renders it highly probable that such were the creatures which Hanno, the explorer, saw captured, and called 'gorillas.'"

Battell, an English sailor, while a prisoner of the Portuguese, in Angola, speaks, it is believed, of the same creature, which, he says, is called "pongo," and of which he seems to have entertained precisely similar notions:—"He is in all proportions like a man, but that he is more like a giant in stature than a man; for he is very tall, and hath a man's face, hollow-eyed, with long hair upon his brows; his body is full of hair, but not very thick, and is of a dunnish color. He differeth not from man but in his legs, for he hath no calf. He goeth always upon his legs, and carrieth his hands clasped on the nape of his neck when he goeth upon the ground. They sleep on the trees, and build shelter from the rain. They feed on the fruit that they find in the woods, and upon nuts, for they eat no kind of flesh. They cannot speak, and have no more understanding than a beast. The people of the country, when they travel in the woods, make fires where they sleep at night, and in the morning, when they are gone, the pongoes will come and sit about the fire till it

goes out; for they have no understanding to lay the wood together. They go many together, and kill many negroes that travel in the woods. Many times they fall upon elephants, which come to feed where they are, and so beat them away with their clubbed fists and pieces of wood that they will run roaring away from them. These pongoes are never taken alive, because they are so strong that ten men cannot hold one of them; but they take many of their young ones with poisoned arrows. The young pongo hangs on its mother's body, with its hands fast clasped about her, so that, when any of the country people kill any of the females, they take the young, which hangs fast on its mother. When they die among themselves, they cover the dead with great heaps of boughs and wood, which is commonly found in the forests."

Interesting Discoveries by a Missionary.

Of these creatures no further account was given, until attention was devoted to them by Dr. Thomas Savage, a member of the Boston Society of Natural History, and at the time a medical missionary. On his voyage to America from Cape Palmas, he was unexpectedly detained on the Gaboon river, and the month of April, 1847, was spent at the house of the Rev. J. L. Wilson, senior missionary of the American Board of Foreign Missions to West Africa. Soon after his arrival, Mr. Wilson showed him a skull, represented by the natives to be that of a monkey-like animal, remarkable for its size, ferocity, and habits; and the doctor was led to believe that it had belonged to a new species of orang. Intent on further investigation, and, if possible, on deciding the point by the inspection of a specimen alive or dead, Mr. Wilson entered cordially into the matter, and promised his full co-operation; and having been a resident in the country for several years, well acquainted with the chiefs and people, highly regarded by them, and speaking freely their language, he was able to render the doctor advantages of signal importance. He did not succeed, however, in obtaining either a living or a dead specimen, but only several skulls of the two sexes, and of different ages, with other important parts of the skeleton of the gorilla. These portions were afterwards ably described, with several engravings, in a quarto pamphlet, on the return of Dr. Savage to America, by Dr. Wyman, professor of anatomy in Harvard University.

Professor Owen has recently given a full and most elaborate description of this creature, from which only a few particulars can now be taken. The lofty ridges of the skull, he affirms, give to the face of the gorilla a most forbidding appearance; the thick covering forming a scowling pent-house over the eyes. The nose is more prominent than in the chimpan-

zee or orang-outang. The mouth is very wide, the lips large, and the chin very short and receding. The huge canine teeth in the male are very frightful. The eyelids have eyelashes, but there are no eyebrows; the ears are smaller in proportion than in man, and much smaller than in the chimpanzee. The length of the upper limbs is not greater than in man when compared with the trunk; they seem longer through the disproportionate shortness of the lower limbs.

The arm is longer than the forearm, which is remarkable, and the thumb reaches to beyond the first joint of the fore-finger, while it does not extend to that joint in the chimpanzee or other ape. The hand excites attention from the breadth, thickness, and great length of the palm; the fingers appear short, taper quickly at the ends to the nails, which are not larger or longer than in man. The back of the hand is hairy as far as the divisions of the fingers; the palm naked and callous, and the thumb scarcely half as thick as the fore-finger. The leg has no "calf," and grows thicker from the knee to the ankle. The sole of the foot is more walked upon than by the chimpanzee, or any other ape. The hind thumb or great toe is stronger than in those creatures; it stands out like a large thumb from the rest of the foot; its base swells below into a kind of ball; the nail is small and short. The sole is wider than in man, the foot more like a hand, but one of huge dimensions and immense power of grasp. And yet, the gorilla, judging from the structure of his grinding teeth, lives on fruits.

A Creature with Awkward Movements.

The gait of the Gorilla is shuffling; the motion of the body, which is never upright as in man, but bent forward, is somewhat rolling, or from side to side. The arms being longer than those of the chimpanzee, it does not stoop as much in walking; like that animal, it advances by thrusting its arms forward, resting the hands on the ground, and then giving the body a half-jumping, half-swinging motion between them. In this act it is said not to bend its fingers, but to make a fulcrum of its hand. When it assumes the walking position, it balances its huge body by bending the arms upwards.

The gorillas live in bands, which are not so numerous as those of the chimpanzee. Only one adult male is said to be seen in a band; and when the young males grow up, a contest takes place for mastery, and the strongest, by killing and driving out the others, establishes himself as head of the band. Dr. Savage says, "the silly stories about their carrying off women from the native towns, and vanquishing elephants, are unhesitatingly denied." Their dwellings, if they may be so called, consist simply



THE WORLD-RENOWNED GORILLA.

of a few sticks and leafy branches, supported by the limbs of trees. The natives call the gorilla a fool, to make a house without a roof, in a country where they have so much rain. They say he has not so much sense as a certain bird, which Mr. Wilson pointed out to Dr. Savage, which makes a large nest with a tight roof, then daubs it with mud in the inside, and, unfolding its wings, whirls round and round till the crevices are all filled, and the inside is smoothly plastered like a house. The huts of the gorilla are only occupied at night. These animals are exceedingly ferocious. The few that have been captured were killed by elephant hunters and native traders, as they came suddenly upon them while passing through the forests.

Frightful Screams and Terrible Ferocity.

When the male is first seen he gives a terrific yell that resounds far and wide through the forest. His enormous jaws are widely opened at each expiration, his under lip hangs over the chin, and the hairy ridge and scalp is contracted on the brow. The females and young disappear at the first cry. He then approaches the foe, pouring out in quick succession his horrid yells. The hunter waits his advance with his gun extended; if his aim is not sure he permits the animal to grasp the barrel, and as he carries it to his mouth, according to his habit, the hunter fires; should the gun fail to go off, the hunter is at the mercy of the huge beast, and in such an unequal combat he is speedily dispatched by his furious foe.

The killing of a gorilla is considered an act of great skill and courage, and brings to the victor signal honor. A slave to a native, from an interior tribe, killed a male and female, and from these specimens we have collected the materials of our description of the species in general. On one occasion this slave had killed an elephant, and, returning home, met a male gorilla, and, being a good marksman, brought him speedily to the ground. He had not proceeded far before the female was observed, which he also killed. Such acts, unheard of before, were deemed almost superhuman; his freedom was immediately granted, and his name made known as the prince of hunters.

The gorilla was first introduced to the scientific world by Andreas Batell, who gave an extensive description of this monster. There are specimens of the animal, more or less complete, in the collections at Philadelphia, Boston, London and Paris. When Du Chaillu returned to the United States in August, 1859, from the country about the Gaboon River, he brought with him complete specimens, male and female, both skins and skeletons, in excellent preservation. Du Chaillu is the first

white man who killed a gorilla with his own hand, or who had an opportunity to study its habits in its native forests.

The adult male is from five to six feet high, though after death it may be stretched beyond this. It far surpasses man in the dimensions of the head, neck, body and arms and in the width of the shoulders; some are said to measure from seven to nine feet from the end of one outstretched hand to that of the other. It is principally an inhabitant of the woods. Its favorite mode of progression is on all fours. When it assumes the erect posture it flexes the arms upward or crosses them on the nape in order to counterbalance the tendency of the trunk to fall forward.

Hands That Can Bend a Gun Barrel.

Its strength is enormous not only in the jaws, which can crush the barrel of a musket, but in the hands and feet, which it uses in attack and defence. The males are very ferocious, generally attacking man and animal intruding upon their haunts. If wounded the gorilla is more terrible than the lion. They advance on the enemy in an erect position, a few steps at a time, beating their breasts with both hands and roaring terribly. When near enough they spring upon him and destroy him with their powerful hands. It has never been possible to capture the gorilla alive, because not even ten men have been able to hold it tight. If one of these monsters dies, the others cover the body with a large pile of branches and wood. Such piles are frequently found in the forests.

Du Chaillu's Graphic Description.

The great gorilla, as slain by Du Chaillu—and he shot several large males—did not, in any case, appear to die hard; but it must be remembered that he allowed the beast to get close upon him before he gave him the fatal shot. It is, he says, a maxim with the well-trained gorilla-hunters to reserve their fire till the very last moment. Experience has shown them that—whether the enraged beast takes the report of the gun for an answering defiance, or for what other reason unknown—if the hunter fires and misses, the gorilla at once rushes upon him; and this onset no man can withstand. One blow of that huge paw with its nails, and the poor hunter's entrails are torn out, his breast-bone broken, or his skull crushed. It is too late to re-load, and flight is vain. I imagine no animal is so fatal in its attack on man as this, for the reason that it meets him face to face, and uses its arms as its weapons of offence, just as a man or prize-fighter would—only that it has longer arms, and vastly greater strength than the strongest boxer the world ever saw. In all my hunts and encounters with this animal, I never knew a grown male to run off.

The hunter, looking with fearful care to his priming, stands still, gun

in hand, often for five weary minutes, waiting with growing nervousness, for the moment when he may relieve his suspense by firing. I have never fired at a male at greater distance than eight yards, and from fourteen to eighteen feet is the usual shot. At last the opportunity comes; and now the gun is quickly raised, a moment's anxious aim at the vast breadth of breast, and then pull trigger. Fortunately, the gorilla dies as easily as man; a shot in the breast, if fairly delivered, is sure to bring him down. He falls forward on his face, his long, muscular arms outstretched, and uttering with his last breath a hideous death-cry, half roar, half shriek, which, while it announces to the hunter his safety, yet tingles his ears with a dreadful note of human agony.

In his attack, at least upon man as his adversary, the male gorilla has a mode of doing it that is very peculiar; and if correct, as described by Du Chaillu, it has the stamp of being remarkably uniform among the species. The similarity of manner taken by several of these male beasts, in going to the encounter, is quite surprising, since it looks like the result of some drill, which these animals had previously put into practice by concert. But the gorilla's brain warrants no such supposition; and his conduct, general and particular, gives proof of the presence of only a slender amount of intelligence. "The corresponding small amount of brain," says Du Chaillu, "in the male gorilla, and the excessive preponderance of the cerebellum or back brain, with its enormous strength, would seem to corroborate our opinion of the excessive brutality of this beast." How, then, is the uniformity of the operation to be accounted for? Is it in any way instinctive? Here, however, the oddly offensive attitude put on by the gorilla while entering the scene of conflict shall speak for itself.

Exciting Combat with an Immense Gorilla.

One day, after travelling some hours in search of the great ape, Du Chaillu tells us he found his first gorilla in a dense and impenetrable part of the forest. Suddenly Miengai, a native, uttered a little cluck with his tongue. Immediately I noticed a noise, as of some one breaking down branches or twigs of trees. This was the gorilla, I knew at once, by the eager and satisfied looks of the men. We walked with the greatest care, making no noise at all. The countenances of the men showed that they thought themselves engaged in a very serious undertaking. Suddenly, as we were creeping along, in a silence which made a heavy breath seem loud and distinct, the woods were at once filled with the tremendous barking roar of the gorilla.

Then the underbrush swayed rapidly just ahead, and presently before us stood an immense male gorilla. He had gone through the jungle on

his all-fours ; but when he saw our party he erected himself, and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high, with immense body, huge chest, and great muscular arms, with fiercely glaring large deep gray eyes, and a hellish expression of face, which seemed to me like some nightmare vision ; thus stood before us the king of the African forest.

He was not afraid of us. He stood there, and beat his breast with his huge fists till it resounded like an immense bass drum, which is their mode of offering defiance ; meantime giving vent to roar after roar. The roar of the gorilla is the most singular and awful noise heard in these African woods, and closely resembles the roll of distant thunder along the sky.

Demonish Monster.

His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now, truly, he reminded me of nothing but some hellish dream-creature—a being of that hideous order, half man, half beast, which we find pictured by old artists in some representations of the infernal regions. He advanced a few steps—then stopped to utter that hideous roar again—advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired, and killed him.

With a groan, which had something terribly human in it, and yet was full of brutishness, he fell forward on his face. The body shook convulsively for a few minutes, the limbs moved about in a struggling way, and then all was quiet—death had done its work, and I had leisure to examine the huge body.

This gorilla onset, then, is remarkable as being attended by advances, halts, roars, and beatings of the breast, and it is all the more striking since it is not the conduct of an individual alone, for this celebrated traveller and strongly nerved hunter says, that the others of this species, shot by him, behaved in the very same way.

The Orang-Outang.

This is the common name of the large tailless anthropoid, or man-like apes, of Southeastern Asia and the islands of Borneo and Sumatra. The adult orang or pongo is more powerful and less anthropoid than the chimpanzee. It represents in Asia the gorilla of Africa and varies in

height from five to seven feet. The Bornean pongo has long loose hair of a deep fuscous color, approaching in some parts to black, the adult male having large fatty protuberances over the cheek bones, not found in the Sumatran species. They are fond of low, marshy, well-wooded regions, their whole organization being fitted for progression on trees.

They seldom move far on the ground and then on all-fours or by swinging the body awkwardly forward between the arms supported by the bent knuckles. They build a kind of a nest or lair on trees, where they spend the night, leaving it late in the morning, when the sun has dispersed the dew and thoroughly warmed the air. They do not live in society except when a pair have a family in charge.

The food consists of fruits, nuts, leaves, tender plants, and is entirely vegetable. In captivity the disposition of the orang-outang is gentle and affectionate. Their intelligence and powers of imitation are remarkable and they get to be fond of the food of man, especially his drinks, such as ardent spirits and coffee. They are perfectly devoid of the disgusting ferocity so conspicuous in some larger baboons and monkeys, and in general are so docile that they may be taught to perform with dexterity a great variety of tricks.

An Adversary to be Shunned.

This monkey never walks erect, except, when it assists its clumsy motions by taking hold of branches, or, when threatened by an enemy. The pictures that represent it walking erect by the aid of a huge stick, are entirely imaginary. In a wild state, the orang-outangs are said to be savage and ferocious and if a negro should wander in the woods and be discovered by them, it is alleged that they attack and kill him. With a piece of wood in their hands or with their fists only, they are able to drive off even the elephants. It is said, that during the breeding season the males leave their habitations or lairs to the females and their youngsters and that, as soon as the young ones have attained a sufficient degree of strength, they hang on the breast of their mother with their arms clasped fast around her.

Many interesting stories are told about the tricks and the intelligence of orang-outangs, while in captivity. A female orang-outang from Borneo was brought alive to Holland and lodged in the menagerie of the Prince of Orange. She was very gentle and exhibited no symptoms of fierceness or malignity. She had a melancholy appearance, yet loved to be in company. Many times when her keeper sat near her on the ground she would take the hay of her bed, arrange it by her side, and with the greatest affection invite him to sit down.



ASIATIC ORANG-OUTANG.

One morning she contrived to escape from her cage and soon afterwards was seen to ascend the beams and oblique rafters of the building. The efforts of four men were necessary to secure her. She would eat of almost every kind of food that was given to her, but she lived chiefly on bread, roots and fruit. She also ate meat both boiled and roasted, as well as fish, and was fond of eggs, the shells of which she broke with her teeth and then sucked out the contents. This animal was seen and described by the great naturalist Buffon.

Of an orang-outang which Le Compte saw in the Straits of Malacca, he says that all its actions were so imitative of those of mankind and its passions were so expressive and lively, that a dumb person could scarcely have rendered himself better understood. This animal was extremely gentle and showed great affection towards every person from whom it received any attentions. Its agility was almost incredible.

The chimpanzee is a much livelier and more light-hearted animal than the orang-outang.

An under-aged specimen was once brought to England from Java, and in order to be made secure, was fastened to a strong staple; but his keeper had no sooner done it, than he had unfastened it, and run away with the chain; but finding its drag embarrass him, he formed it into a coil, and threw it over his shoulder. Other attempts to secure him failed also, and he clung to the ropes of the vessel with such pertinacity and power of muscle, that though the sailors sometimes shook them with the utmost violence, he still retained his hold. At times he would appear to be playing the pranks of a child in anger.

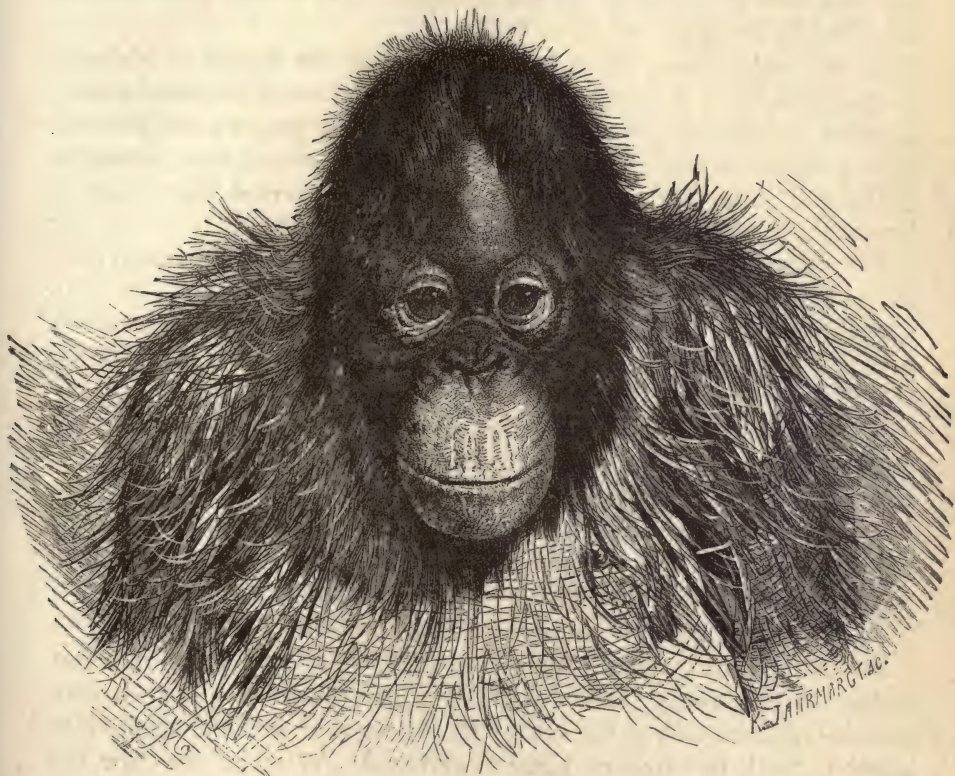
The Orang-Outang in Hysterics.

When tantalized with an orange, he would give utterance to the most violent shrieks, swing himself furiously about the ropes, and then with piercing screams rush at the side of the vessel, as if with the intention to commit suicide by throwing himself overboard. When off the Cape, the temperature became low, especially in the morning; and the tropical orang, like a true thermometer, indicated the full extent of the change, by descending from the mast, shuddering with cold, and endeavoring to make himself snug in the arms of any one of his friends to derive heat, screaming violently if any attempt was made to remove him. He died in less than two years after his arrival.

One being conveyed to Holland was observed, when about to lie down on shipboard at the approach of night, to prepare her bed by shaking well the hay on which she slept, and after putting it in proper order, would wrap herself snugly up in the quilt. In addition to the making of

her bed very neatly every day, she was accustomed to bind up her head with a handkerchief before she retired to rest.

The former, on the voyage to Holland, noticed that the padlock of her chain was opened with a key. The ape soon began to practise the manœuvre, by taking up a little bit of stick, and after putting it in the key-hole of the lock, endeavored to open it by turning the stick in all directions. One morning when on shore she escaped from her chain, and



PORTRAIT OF THE ORANG-OUTANG.

during the time of her liberty, she took the cork from a bottle of Malaga wine, and appeared highly gratified with the contents, which she drank to the very last drop, and then put the bottle in its place again.

It is said of Milo, of Crotona, that he saved the life of Pythagoras, his tutor, by his amazing strength, but lost his own by an equal amount of folly. He was so strong that he could carry a bullock four years old upon his back, and he therefore fancied he could tear up a tree by its roots like an elephant, and then break it to pieces. Having accomplished the

former, his strength became exhausted in the attempt at the latter, and when the tree was half cleft, Milo allowed his fingers to become pinched in the crevice at the moment when the reuniting force of the tree was gaining its power over that of his own and being then held fast, the wild beasts came and devoured him.

A Cunning Device.

Now it appears that the instinct of the orang, in a similar case, imparts to the animal a wisdom superior to that of Milo; for, according to Gemelli Carreri, these creatures sometimes descend from the mountains to the sea-coast, where they find some food in a species of shell-fish, particularly in a large sort of oyster, which they find lying open on the shore. Before putting in their paws, they take the precaution to insert a stone between the shells, to prevent their closing together, and thereby crushing their clutches. They then drag out their prey in safety, and devour it at their leisure.

A naturalist who had two orangs, male and female, in his house in Batavia, says that when any person set his eye intently upon the female, she would throw herself into the arms of her male, and there conceal her face in his bosom. Of the male and female taken on board, the former fell sick during the voyage, and submitted to be treated in the manner of a human patient. His disease being a kind of inflammation, led the surgeon to bleed him twice in the right arm, and ever afterwards the ape, when discovering any return of his indisposition, did not fail to hold out his arm for the purpose of again letting blood.

Orangs often go forth in large numbers to plunder gardens and villages. If there is no appearance of any person near, he makes signs to his companions to enter the vineyard or orchard, and begin their plunder; but as soon as the sentinel perceives anybody coming, he instantly sets up a loud cry, and the whole company scamper off with the utmost precipitation, and jumping from tree to tree, retreat to the mountains. It is a great curiosity to see these animals retreat, for the females carry four or five young ones upon their backs, and with this heavy load leap with great agility from branch to branch, though great numbers of them are taken, notwithstanding their cunning. When they are angry, they bite; but while they are coaxed they are very tame. Those that are tamed perform wonders, and imitate mankind in almost everything they see them do.

Affecting Death.

As we have the means of knowing how the orang-outang dies, it will perhaps not be considered irrelevant to our purpose if we allow its description a place here by way of concluding our references to the

habits of this singular animal. The manner of its death is truly affecting, and probably such that no humane person would wish to see it a second time. A male orang was killed at Ramboom by the crew of a ship. From an article in the *Encyclopædia Britannica*, we quote this description:

He was upwards of seven feet in height when placed in a standing posture, and measured eight feet when suspended by the neck for the purpose of being skinned. On the spot where he was killed, there were several tall trees, which greatly prolonged the attack; for such was his strength and agility that his pursuers were unable to take a determinate aim, until they had felled all the trees but one. He received numerous balls before he was brought down, and then he lay upon the ground as dead, exhausted by many wounds, with his head resting on his folded arm. It was at this time that an officer attempted to give him the finishing stroke, by thrusting a spear through his body; but he instantly sprung upon his feet, wrested the weapon from his antagonist, and shivered it in pieces. This was his last effort, yet he lived some time afterwards, and drank, it is said, great quantities of water. He appeared to have travelled from some distance to the place of the "untoward event," for his legs were caked with mud up to the knees. On the reception of each deadly wound he placed his hand over the injured portion, and distressed even his relentless pursuers by the human-like agony of his countenance. Indeed, his piteous actions, and great tenacity of life, are said to have rendered the scene altogether highly affecting. At the same time, it seemed odd that so much sentimental perception should have been vouchsafed to those who committed the onslaught, and who were under no absolute necessity of bringing the business to so tragical a close.

The Guereza.

The general color of this monkey is black. The sides of the body and top of the loins are ornamented with long, pendent, white hairs, forming a fringe-like mantle. The face is encircled by white, and the tail ends in a white tuft. It is found in South and West Abyssinia. The guereza, which is the Abyssinian name of this species, lives, according to Rüppell, in small families, tenanted the lofty trees in the neighborhood of running waters. It is active and lively, and at the same time gentle and inoffensive. It is the prettiest of all the monkeys, and our illustration gives an idea of its striking appearance. It is an excellent climber. Formerly the skin of the guereza was used by the Abyssinians for decorating their shields, but with the introduction of fire-arms the demand for shields and for this coveted decoration ceased, and this is undoubtedly a fact to be

glad of, because there exists no more instigation to hunt this beautiful and entirely harmless animal.

It has the head, face and neck, back, limbs and part of tail covered with short black velvety hair, the temples, chin, throat and a band over the eyes white, and the sides, flanks, from the shoulders downward, and loins clothed with white hair.

Like all the others, these monkeys are pre-eminently a sylvan race; they never abandon the forests, where they live in society under the guidance of the old males. They seem to be much attached to partic-



GUEREZA WITH BEAUTIFUL FLYING MANTLE.

ular localities. Each tribe or family has its own particular district, into which individuals of other tribes or species are never allowed to intrude, the whole community uniting promptly to repel any aggression, either on their territory or their individual right. So strongly is this propensity implanted within them that they carry it into our menageries. Nothing is more common than to see monkeys of the same species uniting to defend one of their kind against the tyranny of a powerful oppressor, or to resent any insult offered to a member of their little community.

These animals generally take up their quarters in the vicinity of a run-

ning stream, and seldom approach the habitations of men, or invade the cultivated grounds of the gardener and husbandman. No doubt it is their spirit of union and mutual defence which prompts them to collect round travellers, and, by their chattering, grimace, and other means in their power, endeavor to prevent an intrusion into the spot which they regard as their own.

Grotesque Antics of Monkey Tribes.

The Italian boy, with his olive complexion, and long, dark locks, whom you pass in the street, with grinning teeth and with hand to his hat, is grinding an organ, on which sits a monkey fantastically dressed, whose duty consists in performing a certain number of gambols on the pavement, and carrying to his master the pennies they earned for him. The sight recalls the times long since passed, when the merry-making couple, the minstrel and the monkey, were constantly welcomed by barons bold and ladies fair in hall and bower; nor can we forget that when a great change took place in English manners, the monkey continued a favorite, though admittance was refused to the minstrel.

The extraordinary proboscis monkey is remarkable for a peculiar development of the nose, rudimentary at an early age, but afterwards forming a proboscis capable of being dilated, having apertures underneath the bent down point, and divided from each other by a thin cartilage. The ears are small, and the face, together with the palms, are of a leaden color, with a slight tinge of yellow. On the sides of the neck, which is short, and on the shoulders, the hair is long compared with that of the rest of the body. The top of the head and the upper portion of the back are of a rich chestnut brown, the sides of the face and a stripe over the shoulders are yellow; the general color of the body is of a sandy-red. The tail, like some other parts, is dark above and yellow beneath, and is somewhat tufted at the tip. A full beard, in the males, curls up under the chin, and reaches almost to the nose.

The male is remarkable for his size and strength, and must be formidable, from the largeness of his canine teeth. The female is considerably smaller. According to Wurmb, "these monkeys associate in large troops; their cry, which is deep-toned, resembles the word *kahan*." This name has, therefore, been given to the long-nosed monkey. Wurmb also says, "They assemble morning and evening, at the rising and setting of the sun, along the borders of rivers, and are to be seen on the borders of lofty trees, where they offer an agreeable spectacle, darting with great rapidity from one tree to another, at the distance of from fifteen to twenty feet. I have not observed that they hold their nose while leaping as the natives

say they do, but I have seen that they then stretch out their paws in a remarkable manner."

The baboons belong to a family of monkeys, which is called cynocephalus by Cuvier. They are among the largest of the four-handed animals. Their strength is enormous; they are fierce and malignant and their habits are disgusting. In a wild state they are very cunning,



DOG-FACED BABOONS.

and when attacked are dangerous enemies. They run well on the ground and are also excellent climbers. They feed on fruits, roots, the tender twigs of plants, and occasionally on eggs and young birds. In captivity they will eat almost anything. When confined in a cage they will sometimes shake its bars so powerfully as to make the spectators tremble.

In Siam they are said to frequently sally forth in great numbers and to attack the villages, while the inhabitants are occupied in the rice harvest, and to plunder the habitations of whatever provisions they can lay their hands on. In captivity they are always savage and ill-natured; they frequently grind their teeth and fret with great fury. The dog-faced baboon is from four to five feet high. The head and face greatly resemble those of a dog. The hair is peculiarly long and shaggy as far as the waist, but short on the hinder parts. The face is naked and the ears are pointed and concealed in the fur. These animals usually congregate in vast companies. Among the mountains near the Cape of Good Hope, there are immense troops of these baboons or of a kind called ursine baboons. When any person approaches their haunts, they set up a universal and horrible cry and then conceal themselves in their fastnesses and keep silence.

A Pack of Thieves.

They seldom descend to the plains, except for the purpose of plundering the gardens, that lie near the foot of the mountains. While plundering they place sentinels, to prevent a surprise. They break the fruit in pieces and cram it into their cheek pouches, in order afterwards to eat in leisure. The sentinel, if it sees a white man, gives a loud yell and the whole troop retreats with the utmost expedition.

This baboon is also found in Abyssinia and Nubia, where they live in caverns and fastnesses which are protected against the weather by overhanging rocks. When attacked they defend themselves by throwing large stones at their enemies. In captivity they are generally kept chained to a pole and their agility in climbing, leaping, and dodging any one that offers to strike them is almost incredible. It is impossible at the distance of a few yards to hit them with a stone. They will either catch it like a ball, or will avoid its blow with the most astonishing agility.

Awkward Situation.

A strange encounter with a troop of baboons in Kaffraria, occurred to the Rev. F. Fleming, Chaplain to her Majesty's forces, who relates it as follows: Whilst on an excursion to Perrie Bush, the author started from the village alone for the purpose of visiting the saw-pits, which were about a mile or more towards the middle of the forest. Having reached these, and transacted the business in hand, he was informed of a small rivulet, at a little distance further among the woods, forming some very picturesque cascades, and the banks of which were covered with a beautiful and rare kind of flower.

Seduced by the wild loveliness of the scene, he advanced further on, at

the other side of the stream, along what is called a Kaffir path; but, soon getting off this he became entangled in the bush and underwood. The foliage overhead being so thick as to exclude the sun, a small pocket-compass was the only safe guide; and, whilst trying to adjust and steady this, he was saluted by a volley of broken sticks and berries from overhead. Never dreaming of such an attack, and not being able to see the slightest vestige of animals near, he still continued his occupation, when a second similar salute made him gladly pocket the compass, and make towards the low ground in hopes of finding the stream. This he soon reached, and, when on its bank, more easily recovered the lost path.

During his perplexity, however, the chattering overhead soon betrayed the assailants to be a large herd of baboons, whom he now thought, when clear of the thicket, he might tease in his turn. Accordingly he commenced throwing stones at such as were within reach; when, instead of taking to flight, as he expected they would, to his great consternation he beheld, from every tree near him, five or six of these great creatures, swinging from branch to branch, and making towards himself and the ground.

A Race For Life.

Having no gun and no whip with him, he now thought it full time to decamp, which he immediately did, running faster, probably, than ever he did before or has done since, and pursued at full cry—if cry the dreadful noise could be termed—by fifty or sixty ugly, awkward wretches, that seemed to mock at the courage of their adversary, and certainly despised his ill-judged plan of attack and defence. At the saw-pits, however, they sounded a halt, fearing that he would find a reinforcement there among the sawyers. But this, to his great dismay, was not forthcoming, as they had gone home to the village for dinner. He therefore tried to increase his speed, and finally succeeded in getting away from them and back to Perrie, very glad indeed to escape so easily; and his face and boots telling rather plainly there whether he had been following after the beautiful, or the baboons after him.

A baboon alone would doubtless be found an awkward customer; for his great strength and activity, and the powerful canine teeth with which he is furnished, would render him a formidable enemy, were he, from desperation, forced to stand and defend his life. It is most fortunate that the courage of these animals is merely sufficient to induce them to act on the defensive. This, indeed, they only do against a man when driven to it by fear; otherwise they generally prefer prudence to valor. Had their combativeness been proportioned to their physical power, coming, as they

do frequently, in bodies of two or three hundred, it would be impossible for natives to go out of their villages, except in parties, and armed; and, instead of little boys, regiments of armed men would be required to guard the corn-fields.

I have frequently seen baboons, says a traveller, turn on dogs, and have heard of their attacking women, whom they may have accidentally met



LION MONKEYS STEALING COCOANUTS.

alone in the roads or woods. On one occasion I was told of a woman who was so grievously maltreated by them, that, although she was succoured by the opportune help of some passers-by, she died a few days after, from the fright and ill-treatment she had endured.

A baboon was described by Buffon as not altogether hideous, and yet as exciting horror. It appeared to be continually in a state of savage ferocity, grinding its teeth, perpetually restless, and agitated by unprovoked

fury. It was obliged to be shut up in an iron cage, the bars of which it struck frequently with its hand, and thus excited the apprehensions of the spectators.

The Lion Monkey or Marikina.

Our illustration represents this pretty little reddish monkey, which is found in the forests of tropical Brazil, between the twenty-second and twenty-third degree of southern latitude. It lives on high trees, and feeds on fruits and small insects. With its cousins, this pretty little animal shares the propensities and bad habits. It is timid, distrustful, easily excited and passionate, and never shows much affection for its master, like other higher developed monkeys.

They live in pairs, and seem to get along with each other very well. In captivity they are fed with boiled rice, fruit and wheat bread, but now and then they must be given some meat or insects, because animal food is essential to their well-being.

The monkey called the entellus is held sacred in some parts of India, particularly in Lower Bengal. The origin of the extreme veneration which multitudes cherish for this animal is involved in the obscurity of their early history, and may be traced back to the most remote periods. The superstitions and traditions of the Brahmins, in reference to monkeys, hold a prominent place in the "Ramayan," which has been styled a "great epic poem." It describes a struggle between the Hindoo gods, on the one hand, under Rana, and a nation of demons on the other, who are called Rackschasas, and who under their King Ravana, are supposed to reside in the Island of Ceylon. The former, assisted by an invulnerable tribe of monkeys, under their chief, Hoonuman, at length triumphed over the latter.

Some years ago, a rajah spent 100,000 rupees in marrying two monkeys, with all the parade of a Hindoo wedding. The festivities on such an occasion always take place at night. As the bride-groom goes forth to the house of the bride, or as he returns to his own habitation, or to that of his father, he is accompanied by numerous friends and dependents, bearing lamps and torches. When he approaches either house the inmates rush out to meet him, and greet him with their congratulations and best wishes. The path is covered with garments, and lamps, like fire-flies, sparkle in great numbers, all around.

On the so-called marriage of the monkeys, there were seen in the procession, elephants, camels, horses richly comparisoned, palanquins, flambeaux, and lamps. The male monkey was fastened in a gaily-decked palanquin, having a crown on his head, with men standing by his side *

fan him, as they would a human being. Then followed singing and dancing girls in carriages, and for twelve days the festivities were carried on at the monkey's palace.

A very different feeling to that manifested at the monkey wedding is sometimes displayed. Mr. Ward, the missionary, states that he heard of a quarrel between two Brahmins, one of whom was paid by a rich Hindoo to repeat daily the ceremonies of the worship of Hoonuman in his house; the other said, "Thou refuse of Brahmins; thou gainest a subsistence by worshipping a monkey!" Such cases, however, are only exceptional. In Ahmenadab, hospitals were built for the benefit of monkeys, where thousands were kept in fancied ease and indulgence. Gorgeous temples were erected,

With pious care a monkey to enshrine !

Mofleus, in his "History of India," describes a temple of great magnificence; it was supported by no fewer than seven hundred columns, and in front of it was a splendid portico for the reception of the victims intended for the sacrifices. Linschotten relates, that when the Portuguese plundered a palace, in the island of Ceylon, they found in a little gold casket the tooth of a monkey—a relic held by the natives in such veneration, that they offered seven hundred thousand ducats to redeem it; but it was burnt by the Viceroy to stop the progress of such idolatry.

Among the superstitious tales told by the Hindoos in reference to the monkey, there are some of a ludicrous character. Thus, the monkey is said to have carried off the mango from the garden of a celebrated giant whom he had overcome; but as this act of theft was committed after the surrender of the giant, it drew down upon the monkey the vengeance of the gods. To evince their displeasure, therefore, they blackened the face and hands of himself and his race!

In the war already described, Hoonuman, it is said resolved to set fire to the Island of Ceylon, and to destroy his enemies at once, by means of a tar-barrel tied to his tail. No sooner was the plan devised than it was executed; but in the act of burning out his foes, a mischance on which he had not calculated occurred—his own tail caught fire. Stung by the pain, and fearful of losing so ornamental and valuable an appendage, he was about to extinguish the flame by plunging into the sea, but the tribes of the ocean vehemently remonstrated against such a course, which threatened them with being broiled, and compelled him to desist.

CHAPTER XIII.

PECULIAR SPECIES OF BIRDS.

The World's Favorites—Fairies of the Air—Orchestras on the Wing—Creatures whose Clothing Grows on Them—Specimens of Cockatoos—Noisy Flights—Easily Tamed and Affectionate—The Night Swallow—A Fine Streamer—Beauty of Color—Graceful Movements—Esculent Swallow—The Strangest Food in the World—Remarkable Nests—Sappho Humming Bird—Rainbow Colors Darting Through the Air—Sword Bill—Long Beak—Peregrine Falcon—Ancient "Hawking"—A Bird Trained For the Chase—Combat in the Air—Secretary Bird—A Warrior with Wings—Death to Snakes—Power of Leg and Foot—Courage that Never Fails—Remarkable Birds' Nests—Titmouse—Closing the Door of the Nest—A Watchful Sentinel—Sociable Grossbeaks—Wonderful Nest—A Bird that Sews with Thread and Needle—Tailor Bird's Nest—Three-Toed Woodpecker—A Creature that Leaves its Mark—Penguins—Wings and Fins Combined—"Sitting up Like a Major"—Description by Darwin—Training up Young Penguins—The World-Renowned Pelican—Marvelous Sight—Great Assembly of Birds—Montgomery's Poetical Tribute to the Pelican.

BIRDS, says Figuiet, are the spoilt children of nature—the favorites of creation. Their plumage often assumes the most resplendent colors. They have the happy privilege of moving in space—now fluttering through the air, hunting the insect which flits from flower to flower; or soaring high aloft, to swoop upon the victim marked for their prey; again cleaving the atmosphere, and performing journeys of vast extent with great rapidity. Mankind cannot fail to admire these winged beings, which charm at once by the elegance of their form, the melody of their song, and the graceful impetuosity of their movements.

Of all the animals by which we are surrounded in the ample field of nature, there are none more remarkable in their appearance and habits than the feathered inhabitants of the air. They play around us like fairy spirits, elude approach in an element which defies pursuit, soar out of sight in the yielding sky, journey over our heads in marshaled ranks, dart like meteors in the sunshine of summer, or, seeking the solitary recesses of the forest or the waters, they glide before us like beings of fancy. They diversify the still landscape with the most lovely motion and beautiful association; they come and go with the change of the seasons, and as their actions are directed by an uncontrollable instinct of provident nature,

they may be considered as concomitant with the beauty of the surrounding scene.

With what grateful sensations do we hail these faithful messengers of spring and summer after the lapse of the dreary winter, which compelled them to forsake us for more favored climes! Their songs, now heard from the leafy groves and shadowy forests, inspire delight or recollections of the pleasing past in every breast. How volitate, how playfully capricious, how musical and happy, are these roving sylphs of nature, to whom the earth, the air, and the waters, are almost alike habitable. Their lives are spent in boundless action, and nature, with an omniscient benevolence, has assisted and formed them for this wonderful display of perpetual life and vigor in an element almost their own.

Remarkable Clothing of Birds.

The clothing of the skin of birds consists of feathers, which in their nature and development resemble hair, but are of a far more complicated structure. A perfect feather consists of the shaft or central stem, which is tubular at the base, where it is inserted into the skin, and the barbs or fibres, which form the webs on each side of the shaft. The two principal modifications of feathers are quills and plumes, the former confined to the wings and tail, the latter constituting the general clothing of the body. Besides the common feathers, the skin of many birds, and especially of the aquatic species, is covered with a thick coating of down, which consists of a multitude of small feathers of peculiar construction; each of these down feathers is composed of a very small, soft tube imbedded in the skin, from the interior of which there rises a small tuft of soft filaments, without any central shaft.

This downy coat fulfils the same office as the soft, woolly fur of many quadrupeds, the ordinary feathers being analogous to the long, smooth hair by which the fur of those animals is concealed. The skin also bears a good many hair-like appendages, which are usually scattered sparingly over its surface; they rise from a bulb which is imbedded in the skin, and usually indicate their relation to the ordinary feathers by the presence of a few minute barbs toward the apex.

Once or twice in the course of the year the whole plumage of the bird is renewed, the casting of the old feathers being called moulting. In many cases the new clothing is very different from that which it replaces, and in birds inhabiting temperate and cold climates we can frequently distinguish a summer and winter dress. This circumstance has given rise to the formation of a considerable number of false species, as the appearance of the birds in these different states is often very dissimilar, and it is only by an



WHITE AND RAVEN COCKATOOS.

accurate study of the living animals, which is of course almost impossible with many exotic birds, that such mistakes as these can be prevented or rectified. Another fertile source of similar errors is to be found in the difference which very commonly exists between the two sexes, a difference which is often so great that, without particular information derived from the observation of birds in their native haunts, it would be impossible to refer the males and females to their proper partners; and the difficulty is still further increased by the fact that the young of all birds in their first plumage differ more or less from their parents, and frequently only acquire their mature dress after the lapse of three or four years, the plumage undergoing a certain change at each moult.

The Nose-Cockatoo and Raven-Cockatoo.

Cockatoo is the name given to a certain family of parrots from their peculiar call-note or cry. About a dozen species are found in the forests of the Moluccas, Brazil, and Australia, some preferring high trees near rivers and swamps; others the open plains. They are shy and hard to approach, though their presence is easily known from a distance by the loud screams from their vast flocks. They feed on vegetable substances, seeds, nuts and bulbous roots, which they dig up with their strong claws.

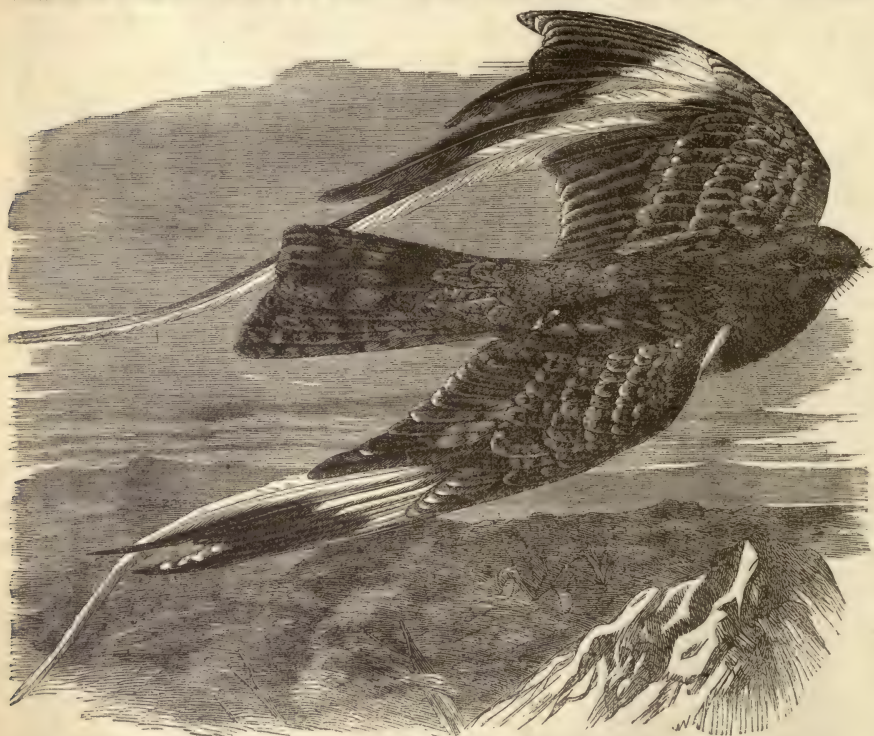
This genus embraces some of the most beautiful species. They are generally of large size, of a white plumage, tinged with rose color or sulphur yellow, and with large crests. Among the finest is the tri-color crested cockatoo with a crest of scarlet, yellow and white, with the tips directed forward, which the bird can open and shut like a fan. The whole of the body is white, tinged with crimson on the neck, breast, sides and under the tail and wings, which are remarkable for their powdery surface.

Another species peculiar to Australia is the nosed cockatoo, characterized by a very large and strong bill, the wings moderate and the tail rounded. They live in small flocks in woods near rivers, feeding on the bark and fruit of the eucalyptus. Their flight is heavy and noisy. They are very shy and more fierce and wild than other parrots. The eggs, two or three in number, are laid in the hollows of decayed trees. One of the finest species is the raven-cockatoo or great black-cockatoo. It is a beautiful, large bird living in the forests of Australia and the eastern islands and generally feeding on the fruits of the eucalyptus, but, different from other parrots, occasionally eating fat worms. They generally live in flocks of four to eight birds. Their flight is heavy; it seldom ascends to a great altitude in the air.

The cockatoos are easily tamed and are of a very affectionate disposi-

tion. Travellers in New South Wales are unanimous in saying that the impression made by the profusion of these magnificent birds surpasses description. As far as known, the black or raven-cockatoos, lay their eggs in the hollows of trees. In captivity they feed on grains of hemp or oats, boiled corn, and are very fond of snails and worms.

The typical genus called swallows, having more than fifty species, embraces several well known swallows both in America and in the Old World.



THE FLAG NIGHT-SWALLOW.

Their food consists of insects, which they take on the wing, usually in the neighborhood of water; they drink on the wing and often wash themselves by a sudden plunge.

They fly at the rate of a mile a minute in their ordinary evolutions, but are rather awkward on the ground; their sight is very acute. They fly low in damp weather, where the insects are most abundant and thence are supposed to foretell rain. They are most numerous in the tropics, migrating to and from temperate regions.

Swallows are easily distinguished from all other birds not only by

SPECIMENS OF THE ESCULENT SWALLOW AND EDIBLE NEST.



their general structure, but by their twittering voice and their manner of life. Several species of night-swallows are found, among which the flag night-swallow, as shown by our illustration, is one of the most interesting and beautiful. This bird is found in the tropical regions of Central Africa.

Salangane or Esculent Swallow.

The salangane is somewhat smaller than the wren. Its bill is thick; the upper parts of the body are brown, and the under parts whitish. The tail is forked, and each feather is tipped with white. The nest of this bird is exceedingly curious, and is composed of such materials that it is not only edible, but is considered a delicacy by the epicures of Asia. It generally weighs about half an ounce, and is in form like a saucer, or one-fourth of an egg, with one side flattened, which adheres to the rock. The texture resembles isinglass or gum-dragon, and the several layers of the component matter are apparent, it being built of parcels or soft slimy substance, in the same manner as the martins form their nests of mud.

There is a difference of opinion as to the materials of which this nest is composed; some suppose it to consist of sea worms or mollusks, or the spawn of fishes; others, of the seaqualm, a kind of cuttle fish, or a glutinous sea-plant called agal-agal, and others assert that the swallows rob other birds of their eggs, and after breaking their shells apply the white of them in the composition of their nests.

Eating Birds' Nests.

The best kind of nests which are free from dirt are dissolved in broth, and are said to give it an excellent flavor, or they are used as stuffing of a fowl. They are found in vast numbers in dark caverns of islands in the Soolo Archipelago, and are sold in China at from one thousand to fifteen hundred dollars for about seventy-five pounds.

The nests adhere to each other and to the sides of the cavern, mostly in rows, without any break or interruption. They are a considerable object of traffic among the Javanese, many of whom are employed in it from their infancy. The birds after having spent nearly two months in preparing their nests lay two eggs which are hatched in about fifteen days. When the young birds become fledged it is the proper time to take the nests, and this is regularly done three times a year, and is effected by means of ladders, by which the people descend into the caverns. This operation is attended with much danger. It is estimated that the annual export of these nests from Java into China represents a value of one million five hundred thousand dollars.

The humming-birds are the most diminutive of all the feathered tribes. They are natives of the warmer parts of America and some of the West India Islands, and bear a great resemblance to each other in manners. Their principal food is the nectar at the bottom of tubular-shaped flowers, which they extract while on the wing, by means of their long and slender bills.



THE SAPHO HUMMING-BIRD.

Their name is derived from the humming noise they make with their wings. In whatever latitude, their manners are the same; very quick and active, almost constantly on the wing, as they dart in the bright sun they display their bills and colors. They rarely alight on the ground, but perch readily on branches. Their nests are delicate, but compact and lined with the softest vegetable downs, about an inch in diameter and

depth, and perched on trees, shrubs and reeds. These little birds are very pugnacious and will attack any intruder coming near their nests. They are incidentally honey-eaters, but essentially insectivorous.

The sappho humming-bird, which is found in Bolivia, is of scarlet-red color on the upper part; the head and under parts being of a green hue, which is lighter and brighter at the throat. The wings are of a purple-



THE SWORD BILL.

brownish color and the tail feathers of garnet color tipped, with dark-brown. The color of the female on the upper parts is green, while the under parts are gray and the tail feathers light-red.

Of all the humming-birds the sword bill has the longest bill, and can therefore easily be discerned from the others. The bill is of the same

length as the body of the bird, slightly bent upwards, a little flattened at the point. The male is of green, the head of copper color, and the under parts of bronze color, the wings brown. The home of this bird is Quito and Venezuela.

The Peregrine Falcon.

The falcons are found throughout the world regardless of climate; they are powerful and rapid flyers, hovering over their prey and dashing perpendicularly upon it. They pursue birds chiefly, but attack also small quadrupeds. The common or peregrine falcon, also called the duck-hawk, is solitary, except during the pairing of the breeding season, which is in very early spring; it is found in all parts of the United States and in Cuba, coming to the south in the winter months. It is distributed over temperate Europe where the country is mountainous and the sea coast precipitous.

Before the invention of gunpowder, falcons were very frequently trained to pursue herons and various kind of game, and falconry was a favorite sport of kings and nobles. Even now falcons are used for this purpose in the Orient, especially Persia. Falconry is the art of training falcons or other birds of prey for the chase, the "hawking," as it is called in England.

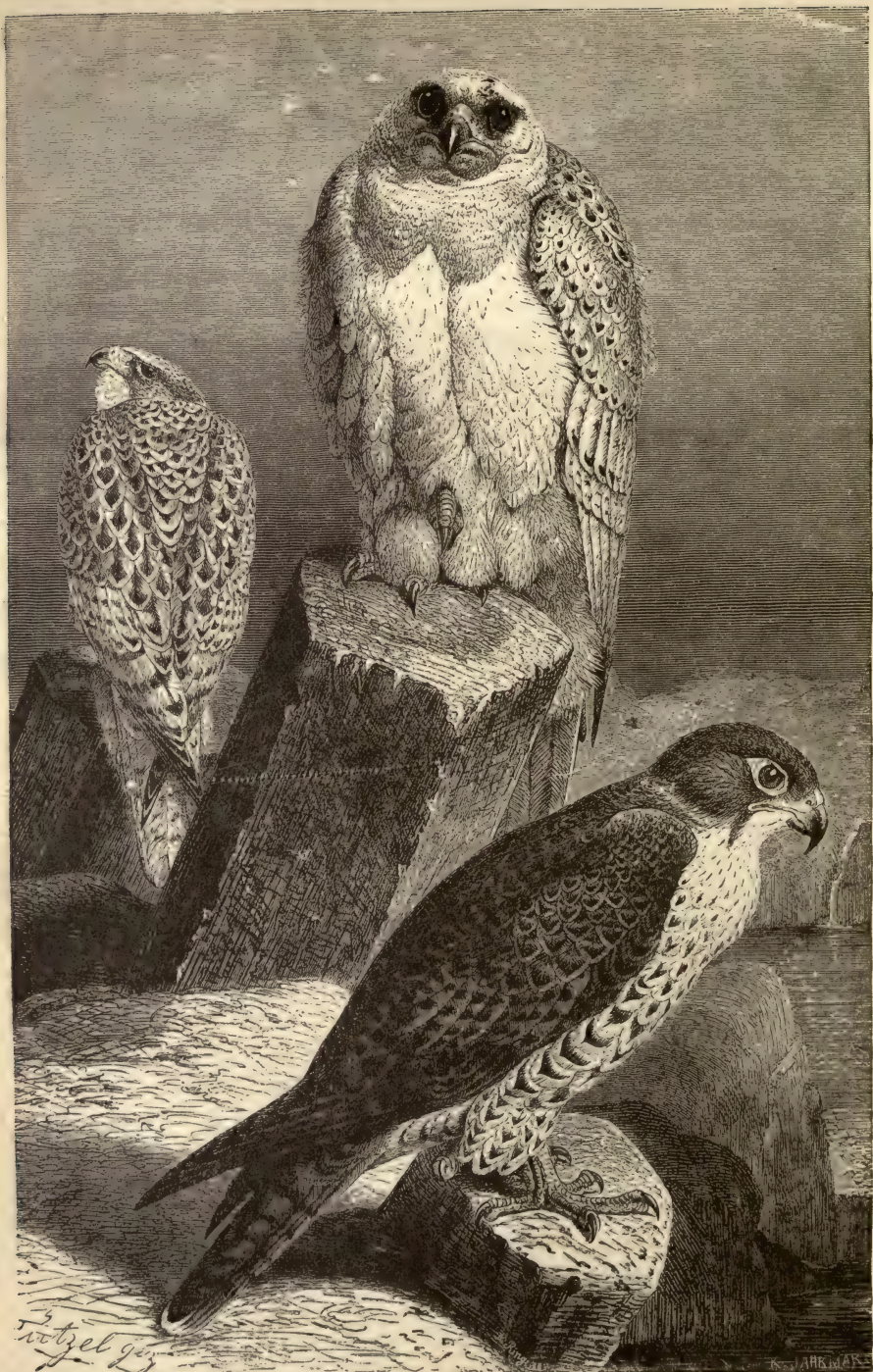
A Bird used in the Chase.

The practice of hunting with falcons is very ancient in Europe and Asia, and was in existence in the fourth and fifth centuries, and was common in England from the eighth century to the time of the Stuarts. The Persians are skillful in training falcons to hunt all kinds of birds, and even gazelles. The peregrine falcon was in the palmy days of hawking one of the favorite falcons chosen for that sport. Its strength and swiftness are very great, enabling it to strike down its prey with great ease. From its successful pursuit of ducks the Americans call it duck-hawk.

There is a peculiarity in the method of attack which this bird employs when pursuing small game. Instead of merely dashing at its prey and grasping it with its claws, the peregrine falcon strikes it with its breast and stuns it with the violence of the blow before seizing it with its claws. The courage of the peregrine falcon is so great that it was generally employed to take the heron.

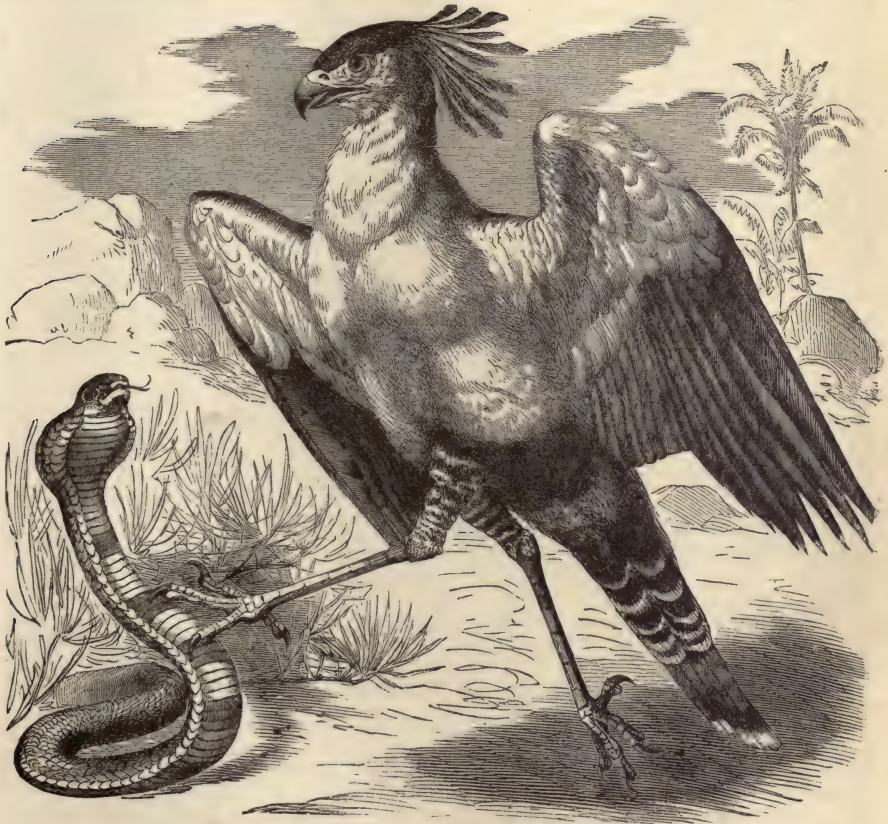
Battle in the Air.

After this bird had been roused the falcon, which had previously been held hooded on the falconer's hand, was loosed from its bonds and cast off. A contest then generally took place between the heron and falcon, each striving to ascend above the other. In this contest the falcon was always



FAMOUS PEREGRINE FALCON.

victorious, and after it had attained a certain altitude it swept or "stooped" upon the heron. When the falcon was closed with its prey, they both came down together and the sportsman's business was to reach the place of conflict as soon as possible and assist the falcon in the battle. The peregrine falcon changes the color of its plumage several times before it arrives at full maturity. It builds on ledges of rocks, laying four eggs of a reddish-brown color.



SECRETARY BIRD KILLING A SNAKE.

There is a very warlike-looking bird which might, at first sight, be thought to belong to the tribe of long-legged storks or cranes. But if you examine his curved beak, you will see that in reality he is a bird of prey. Indeed, some people call him the "secretary eagle."

The reason why the name "secretary" has been given him is because of the crest of feathers on the back of his head, that have a fancied resemblance to a pen stuck behind the ear of a person employed in

writing. But he might be said to have a link with another family of birds, namely, the running birds. He cannot grasp like the eagle, and he does not live, like his noble relative, on high mountains, or soar towards the clouds. On the contrary, he keeps on the ground, and runs here and there on his long legs. So that it is rather a difficult matter to find out where to place him among our feathered friends.

He is one of the most useful birds, and in certain parts of the world is cherished with the utmost care. He does not object to lizards, and even beetles, by way of variety; and as he runs about on the hot, dusty plains of Africa, he finds plenty. But this is child's play; he likes best of all to do battle with a serpent. Many venomous snakes are found in these hot countries, and the natives dread them beyond measure. It is true the snake will rarely attack a man, and, as a rule, glides away from him; but sometimes he may chance to come too near it, as it lies coiled up, and if its terrible fangs do but touch him, he is sure to die.

No Quarter for the Enemy.

The secretary bird is always on the lookout for this natural enemy of man. In the picture he is engaged in a fierce battle with a serpent. The serpent is, as you see, in a rage. At first all its attempts were directed to getting back to its hole, but its enemy was more than a match for it. Whichever way it turned the bird hopped in its path, and stood with flashing eyes and outspread wings. Then the serpent was fairly roused. It raised itself up, swelled out its dreadful neck, and darted out its fangs. For a moment the bird gave way a little, and seemed as if considering what to do.

But his courage soon revived. He was resolved not to be cheated of his prey, so he covered himself with one wing as with a shield, and struck violently at the serpent with the other. The serpent was knocked down by the blow, and every time it attempted to rise, the bird struck at it again. At last the snake could rise no more, and the bird killed it by striking its head with his beak.

Such battles are often taking place, and the bird is much admired for his courage. He is considered a most valuable member of society, and his family have been invited over to the plantations in the West Indies. Here they are highly esteemed, and no one ever thinks of harming them. The plantations abound in snakes, and their number is thinned by the introduction of these their inveterate enemies.

When the snake is small enough, the bird snaps it up, and carries it off to the top of a tree. Then he lets it drop, and follows it, as it descends, with much adroitness, so as to be ready to strike it when it lies stunned

on the ground. He does not always strike with his wing, but with the sole of his foot. He always kills his prey before he devours it.

Serpents are not his only food, for he preys upon lizards and tortoises and insects. The hot unwholesome marsh is full of insects, and the secretary bird thins their number; so that every way he is useful. He and



NEST OF THE WATER-HEN.

his partner make a large nest, in which two eggs are laid. He does not choose his partner without fighting a great many battles. Yet he has not at all a fierce temper, but rather otherwise; and after the choice has been made there are no more quarrels.

The whole tribe of wrens and titmice make us forget their tiny size in

the skillful finish of their work, and the delightful love which reigns in every family; it is sometimes a perfect marvel to witness.

Among these charming guests of our thickets can be distinguished the common wren, which builds a nest similar to a little underground house. Then comes the long-tailed titmouse, the globular abode of which does not exceed the size of the fist, and which is made of moss and lichen. The mother only enters by an excessively narrow opening, and often nourishes ten or twelve little ones. It is quite inexplicable how so numerous a family can be crowded into such a narrow little chamber. One would think they must be stifled; but the young birds, heaped one upon another, are only so much more thoroughly warmed, and the whole brood live happy and gay in their tiny little bed.

Titmouse and Nest.

In respect to the elegance of its construction the penduline titmouse astonishes the observer still more. Its nest, suspended to the branch of a tree, has exactly the shape of a chemist's retort, only that instead of being manufactured of such hard material, nothing enters into the composition of it but fine moss and down. The opening is carefully woven; not one vegetable fibre protrudes beyond the other! Who can describe in what a marvelous manner the bird, while still on the wing, approaches its nest, enters and issues by an opening which seems to have scarcely the diameter of its body, and without ever deranging a fibre?

The huts of some savages remain constantly open; their limited capacity has not yet taught them to invent the protecting door. Spiders are more ingenious. There are some which understand how to secure themselves in their subterranean abodes by a skillfully constructed door. Some birds take analogous precautions.

Jerdon details the curious domestic arrangements of some species the males of which, at the time of laying, imprison the female in her nest. They close the entrance to it by means of a thick wall of mud, leaving only a small hole by which the hen breathes and protrudes her beak to receive her food. To this, indeed, her too stern spouse brings every moment some morsel for her to peck at, for to his praise be it said, that though he is barbarous enough to immure her, he feeds her with the most tender solicitude. This enforced retirement only ceases with the termination of the hatching, when the pair break the prison-door.

In his voyage to India Sonnerat speaks of a Cape titmouse, the nest of which, shaped like a bottle and made of cotton, merits notice. While the female is hatching inside, the male a most watchful sentinel, remains outside, resting in a pouch made for the purpose, fixed to one side of the

IMMENSE NESTS OF AFRICAN SOCIAL GROSBILLS.



neck of the nest. But when his mate moves off and he wishes to follow her, he beats the opening of the nest violently with his wing, and succeeds in closing it, in order to protect his young from enemies.

In respect to ingenuity of construction developed by the love of family and work, there is nothing that can be compared to the doings of the sociable grossbeak. This little Cape bird, of the size and appearance of our sparrows, lives in numerous societies, all the members of which unite to form an immense city, having the appearance of a circular timber-work, embracing the trunk of some great tree. There are sometimes



NEST OF THE TAILOR
BIRD.

more than three hundred little cells, which means that it is inhabited by more than six hundred birds. This nest is so heavy, that Levaillant, who brought one away during his travels in Africa, was obliged to employ a wagon and several men to remove it. When they are seen at a distance in the landscape, we might think we were looking at huge roofs suspended to the trunks or branches of the trees scattered about, and round which a multitude of birds are playing.

We have said that amongst the winged tribe specimens of all industrial arts are found. One would scarcely expect to find regular seamstresses among them, for the beak of the bird seems ill adapted enough for needle-work, and yet some of these animals produce work exactly analogous.

We do not here in any way allude to the weaver-birds, the nests of which, made of fine grass and known to all the world, represent an inextricable net-work; but to the tailor-bird, a charming exotic species, which takes two very long lanceolated leaves and sews the edges of them, neatly whipped by means of flexible grass in the form of thread. After this the female fills the little sack which they form with cotton, and deposits her pretty young ones upon this downy bed, which is gently rocked by the least breath of wind. This nest, which is extremely rare, is a real masterpiece of ingenuity.

Woodpecker is the common name of the numerous climbing birds. They are very active, living in woods and forests, continually tapping with the bill the surface of trees to discover soft places, in which are lurking the insects and larvæ, on which they principally feed. They are generally solitary and usually silent; the principal noise they make being

produced by striking the bill against the trees. The three-toed woodpecker is the German representative of this family. It has a dull greenish black color with scarlet patches on crown, crest and cheek, under wings and chin white lined with sulphur yellow.

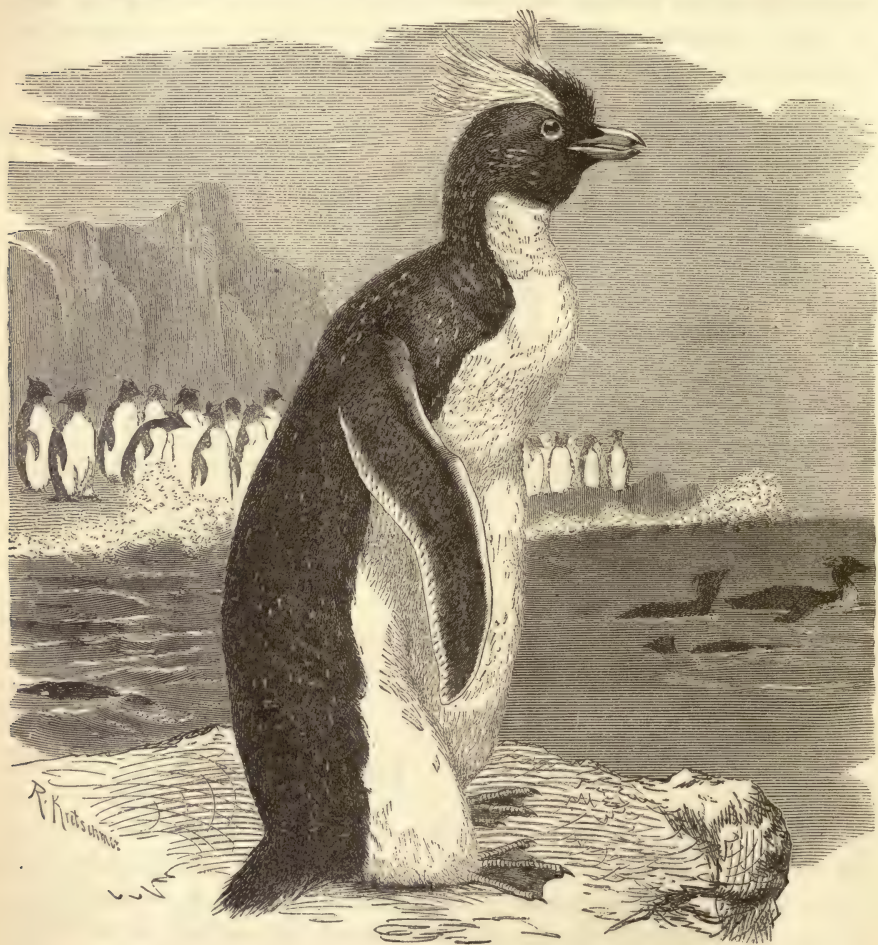
In the penguins the feathers of the wings are rudimentary, and covered with skin, so that they are like fins. These are very useful in swimming, but do not enable the birds to fly. There are several species, abounding in the Antarctic Seas, where they pass the greater portion of their time in



THREE-TOED WOODPECKER.

the water, and appear rarely to stay any time on land, except during the breeding season. In the water they are exceedingly active, swimming and diving with the greatest facility, and making use of their little naked wings as fins, when engaged in the latter operation. When in motion on land, however, they employ these in place of an anterior pair of legs; and by their assistance contrive to scuttle along so rapidly that when they are in motion among the tussocks of grass they might readily be mistaken for quadrupeds. They do not appear to have very acute sensations; Sparman tells us that he stumbled over a sleeping one and kicked it several times

without disturbing its rest. Forster says that he left several of them apparently lifeless while he went in pursuit of others, but they afterward got up and marched off with their usual gravity. They hatch their eggs by holding them between their thighs, and when threatened with danger, move away, still retaining them in this position. During



TUFTED PENGUIN.

the period of incubation the male fishes for the female, and after the young are hatched both parents are engaged for a time in procuring their food.

Mr. Darwin gives the following pleasant account, the scene of the adventure being the Falkland Islands, where these birds abound: One day,

having placed myself between one of these penguins and the water, I was much amused by watching its habits. It was a brave bird, and, till reaching the sea, it regularly fought and drove me backward. Nothing less than heavy blows would have stopped him; every inch gained he firmly kept, standing close before me, erect and determined. When thus opposed, he continually rolled his head from side to side, in a very odd manner, as if the power of vision only lay in the anterior and basal part of each eye. This bird is commonly called the jackass penguin, from its habit, while on shore, of throwing its head backward, and making a loud, strange noise, very like the braying of that animal; but while at sea and undisturbed, its note is very deep and solemn, and is often heard in the night-time. In diving, its little plumeless wings are used as fins; but on the land as front legs. When crawling—it may be said on four legs—through the tussocks, or on the side of a grassy cliff, it moved so very quickly that it might readily have been mistaken for a quadruped. When at sea, and fishing, it comes to the surface, for the purpose of breathing, with such a spring, and dives again so instantaneously, that I defy any one at first sight to be sure that it is not a fish leaping for sport.

How the Old Bird Rears the Young.

The following interesting account, probably referring to this species, is furnished by Captain Fitzroy. He is speaking of Noir Island: Multitudes of penguins were swarming together in some parts of the island, among the bushes and tussocks near the shore, having gone there for the purpose of moulting and rearing their young. They were very valiant in self-defense, and ran open-mouthed by dozens, at any one who invaded their territory, little knowing how soon a stick would scatter them on the ground. The young were good eating, but the others proved to be black and tough when cooked. The manner in which they feed their young is curious and rather amusing. The old bird gets on a little eminence and makes a great noise, between quacking and braying, holding its head up in the air, as if it were haranguing the penguinnery, while the young one stands close to it, but a little lower. The old bird, having continued its clatter for about a minute, puts its head down and opens its mouth widely, into which the young one thrusts its head, and then appears to suck from the throat of its mother for a minute or two, after which the clatter is repeated and the young one is again fed; this continues for about ten minutes. I observed some which were moulting make the same noise, and then apparently swallow what they thus supplied themselves with; so in this way, I suppose they are furnished with subsistence during the time they cannot seek it in the water.

The web-footed pelicans are large and heavy, with immense extent of wing, and are excellent swimmers. The expansive pouch, whose elasticity is well known to all who have witnessed the shapes into which it is stretched and formed by the itinerant showman, will hold a considerable number of fish, and thus enables the bird to dispose of the superfluous quantity which may be taken during fishing expeditions, either for its own consumption or for the nourishment of its young. In feeding the nestlings—and the male is said to supply the wants of the female when sitting, in the same manner—the under mandible is pressed against the neck



THE PELICAN.

and breast, to assist the bird in disgorging the contents of the capacious pouch; and during this action the red nail of the upper mandible would appear to come in contact with the breast; thus laying the foundation, in all probability, for the fable that the pelican nourished her young with her blood, and for the attitude in which the imagination

of painters has placed this bird in books of emblems, with the blood spirting from the wounds made by the terminating nail of the upper mandible into the gaping mouths of her offspring.

The neighborhood of rivers, lakes, and the sea-coasts, are the haunts of the pelicans, and they are rarely seen farther than twenty leagues from the land. They appear to be to a certain extent gregarious. Levaillant, upon visiting Dassen-Eyland, where was the tomb of a Danish captain, beheld, as he says, after wading through the surf and clambering up the rocks, such a spectacle as perhaps never before appeared to the eye of

mortal. "All of a sudden there arose from the whole surface of the island an impenetrable cloud, which formed, at the distance of forty feet above our heads, an immense canopy, or rather a sky, composed of birds of every species, and of all colors—cormorants, sea-gulls, sea-swallows, pelicans, and I believe the whole winged tribe of this part of Africa were here assembled. All their voices, mixed together and modified according to their different kinds, formed such a horrid music that I was obliged to cover my head to give a little relief to my ears. The alarm which we spread was so much the more general among these innumerable legions of birds, as we principally disturbed the females which were then sitting. They had nests, eggs, and young to defend. They were like furious harpies let loose against us, and their cries rendered us almost deaf. They often flew so near us that they flapped their wings in our faces, and though we fired our pieces repeatedly we were not able to frighten them; it seemed almost impossible to disperse this cloud. We could not move one step without crushing either their eggs or their young ones; the earth was entirely strewn with them." The same traveller found on the Klein-Brak River, while waiting for the ebb-tide, thousands of pelicans and flamingoes, some of deep rose-color and others white.

A Pelican Cemetery.

The subject of Montgomery's beautiful poem, "The Pelican Island," was suggested by a short passage in Captain Flinder's voyage to Terra Australis, in which he describes one of those numerous gulfs which indent the coasts of New Holland, and are thickly spotted with small islands. "Upon two of these," he says, "we found many young pelicans unable to fly. Flocks of the old birds were sitting upon the benches of the lagoon, and it appeared that the islands were their breeding-places; not only so, but from the number of skeletons and bones there scattered, it would seem that, for ages, these had been selected as the closing scene of their existence. Certainly none more likely to be free from disturbance of every kind could have been chosen, than these islets of a hidden lagoon of an uninhabited island, situate upon an unknown coast, near the antipodes of Europe; nor can anything be more consonant to their feelings, if pelicans have any, than quietly to resign their breath, surrounded by their progeny, and in the same spot where they first drew it."

The following is one of the poet's pictures of the training of the young :

On beetling rocks the little ones were marshall'd;
There by endearments, stripes, example, urged
To try the void convexity of heaven,
And plough the ocean's horizontal field.

Timorous, at first they fluttered round the verge,
Balanced and furled their hesitating wings,
Then put them forth again with steadier aim ;
Now, gaining courage as they felt the wind
Dilate their feathers, fill their airy frames
With buoyancy that bore them from their feet,
They yielded all their burthen to the breeze,
And sailed and soared where'er their guardians led.
Ascending, hovering, wheeling, or alighting,
They searched the deep in quest of nobler game
Than yet their inexperience had encountered ;
With these they battled in that element,
Their wings or fins were equally at home,
Till conquerors in many a desperate strife,
They dragged their spoils to land, and gorged at leisure.

Another picture, from the same graphic pen, may well be added :

Day by day,
New lessons, exercises, and amusements
Employed the old to teach, the young to learn.
Now floating on the blue lagoon behold them,
The sire and dam in swan-like beauty steering,
Their cygnets following through the foaming wake,
Picking the leaves of plants, pursuing insects,
Or catching at the bubbles as they brake ;
Till on some minor fry, in reedy shallows,
With flapping pinions and unsparing beaks,
The well taught scholars plied their double art,
To fish in troubled waters, and secure
The petty captives in their maiden pouches ;
Then hurry with their banquet to the shore,
With feet, wings, breast, half swimming and half-flying ;
And when their pens grew strong to fight the storm,
And buffet with the breakers on the reef
The parents put them to severer proofs.



CHAPTER XIV.

THE IMPERIAL EAGLE.

Monarch of Mountain and Forest—Majestic Flights—Gazing at the Sun—Ravenous Tyrants—Elevated Nest—Symbol of Roman Empire—Tribute of Mrs. Hemans to Wounded Eagle—Amazing Gift of Sight—Seizure of Marie Delex—A Monster of the Air—Children Carried Away on Wings—Frightful Encounters—A Daring Rescue—Forest King on His Crag—Swift Descent—Shrewd Method of Taking Prey—The Bald Eagle—Dimensions of Sea-Eagle—Preying on Quadrupeds—Mated Once for Life—Osprey or Fish Eagle—Peculiar Foot and Toes—Plunging Down from Vast Heights—Claws of Astonishing Strength—Harpy Eagle—Tenant of Mexico and South America—Hard Fighter—Destroyer of Animal Life—Sure Aim and Fatal Blow—Feathers Used for Decorations—Striking Colors of Plumage.



HE eagle, the monarch of the mountain forests, over which he has reigned since the creation, is still found exercising his dominion in the ancient and remote woods of Europe, Asia, and America, but more particularly in the northern parts. Nuttall thus describes it: Near their rocky nests they are seen usually in pairs, at times majestically soaring to a vast height, and gazing on the sun, toward which they ascend until they disappear from view. From this sublime elevation they often select their devoted prey—sometimes a kid or a lamb from the sporting flock, or the timid rabbit or hare crouched in the furrow, or sheltered in some bush. The largest birds are also frequently their victims, and in extreme want they will not refuse to join with the alarmed vulture in his cadaverous repast. After this gorging meal the eagle can, if necessary, fast for several days.

The precarious nature of his subsistence, and the violence by which it is constantly obtained, seem to produce a moral effect on the disposition of this rapacious bird; though in pairs, they are never seen associated with their young; their offspring are driven forth to lead the same unsocial, wandering life as their unfeeling progenitors. This harsh and tyrannical disposition is strongly displayed even when they lead a life of restraint and confinement. The weaker bird is never willingly suffered to eat a morsel, and though he may cower and quail under the blow with the most abject submission, the same savage deportment continues toward him as long as he exists. Those observed in steady confinement frequently uttered hoarse cries, sometimes almost barkings, accompanied

by vaporous breathings, strongly expressive of their ardent, unconquerable, and savage appetites. Their fire-darting eyes, lowering brows, flat foreheads, restless disposition, and terrific plaints, together with their powerful natural weapons, seem to assimilate them to the tiger rather than the timorous bird. Yet it would appear that they may be rendered docile, as the Tartars, according to Marco Polo, were said to tame this species to the chase of hares, foxes, wolves, antelopes, and other kinds of large game, in which they displayed all the docility of the falcon.

The longevity of the eagle is as remarkable as its strength; it is believed to subsist for a century, and is about three years in gaining its complete growth and fixed plumage. This bird was held in high estimation by the ancients on account of its extraordinary magnitude, courage, and sanguinary habits. The Romans chose it as an emblem for their imperial standard, and from its aspiring flight and majestic soaring it was fabled to hold communion with heaven, and to be the favorite messenger of Jove. The Tartars have a particular esteem for the feathers of the tail, with which they superstitiously think to plume invincible arrows. It is no less the venerated war-eagle of our northern and western aborigines, and the caudal feathers are extremely valued for head-dresses, and as sacred decorations for the pipe of peace.

A Nest in the Tree-Tops.

The eagle builds its nest upon the tops of trees, and prefers those which have the greater number of climbing shrubs about them. Where such are not to be found, it selects a bushy thicket, in which it forms a spacious eyrie of sticks and twining branches, laid nearly flat, and lined with a thick layer of hair inartificially disposed. The female lays two eggs, much pointed at one extremity, and dotted and spotted with crimson on a ground of brownish-red.

The eagle devours the dead and the living. Sometimes four or five unite to pursue a prey that a single one could not master. D'Azara states that he has seen them hunt down red buzzards, herons, and other large birds; and it seems they prey, not only on a variety of smaller creatures, but also on young fawns and lambs. Often do they feast, too, on what others have taken. Thus, if an eagle sees a vulture with a piece of flesh, it will pursue him, and compel him to disgorge it; and the sportsman is not unfrequently foiled by this bird coming and bearing off the game before his eyes.

It is not improbable that similar habits of solitude in the lion and the eagle, together with their magnitude and strength, have given rise to their titles, so generally current, of king of beasts—king of birds. Jons-

ton says in an old work, "England by a Person of Quality :"—"The eagle challengeth the first place, not that it is the best dish at table, for none will eat it, but because it is the king of birds." The ancient Greeks were of the same opinion, for Pindar speaks of "the great eagle, the chief magistrate of the birds."

Dignity and majesty are the common attributes of the eagle. Hence Mrs. Hemans, addressing one of these birds which has been wounded, thus speaks :

Eagle ! this is not thy sphere !
 Warrior bird, what seek'st thou here ?
 Wherefore by the fountain's brink
 Doth thy royal pinion sink ?
 Wherefore on the violet's bed
 Lay'st thou thus thy drooping head ?
 Thou, that hold'st the blast in scorn,
 Thou, that wear'st the wings of morn !

 Eagle ! Eagle ! thou hast bowed
 From thine empire o'er the cloud !
 Thou that hadst ethereal birth,
 Thou hast stoop'd too near the earth,
 And the hunter's shaft hath found thee,
 And the toils of death hath bound thee—
 Wherefore did'st thou leave thy place,
 Creature of a kingly race ?

Stern and unsocial in their character, yet confident in their strength and efficient means of defense, the eagles delight to dwell in the solitude of inaccessible rocks, on whose summits they build their rude nest and sit in lone majesty, while with their keen and piercing eye they sweep the plains below, even to the horizon. The combined extent and minuteness of their vision, often including not merely towns, villages, and districts, but countries and even kingdoms in its vast circuit, at the same time carefully piercing the depths of forests, the mazes of swamps, and the intricacies of lawns and meadows, so as to discover every moving object—even the sly and stealthy animals that constitute their prey—form a power of sight to which human experience makes no approach. If we connect with this amazing gift of vision the power of flight which enables these birds to shoot through the heavens so as to pass from one zone to another in a single day and at a single flight, we shall readily comprehend how it is that they have in all ages so impressed the popular imagination as to render them the standing types and emblems of power. In ancient times the lion was the representative of kings, but the eagle, soaring in the sky, was made the companion of the gods, and the constant associate of Jupiter himself.

Although in our days the carrying off of Ganymede is not re-enacted, yet the inhabitants of mountainous countries have some ground for accusing the eagles of bearing off their children. A well known fact of this kind took place in the Valais in 1838. A little girl, five years old, called Marie Delex, was playing with one of her companions on a mossy slope of the mountain, when all at once an eagle swooped down upon her and carried her away in spite of the cries and presence of her young friend. Some peasants, hearing the screams, hastened to the spot, but sought in vain for the child, for they found nothing but one of her shoes on the edge of the precipice. The child, however, was not carried to the eagle's nest, where only two eaglets were seen, surrounded by heaps of goat and sheep bones. It was not till two months after this that a shepherd discovered the corpse of Marie Delex, frightfully mutilated, upon a rock half a league from where she had been borne off.

Eagle and Child in the Air.

An instance of this kind, which occurred in the autumn of 1868, is thus narrated by a teacher in county Tippah, Missouri: A sad casualty occurred at my school a few days ago. The eagles have been very troublesome in the neighborhood for some time past, carrying off pigs and lambs. No one thought they would attempt to prey upon children; but on Thursday, at recess, the little boys were out some distance from the house, playing marbles, when their sport was interrupted by a large eagle sweeping down and picking up little Jemmie Kenney, a boy of eight years, and flying away with him. The children cried out, and when I got out of the house, the eagle was so high that I could just hear the child screaming. The alarm was given, and from screaming and shouting in the air, the eagle was induced to drop his victim; but his talons had been buried in him so deeply, and the fall was so great, that he was killed.

The Abbé Spallanzani had a common, or black eagle, which was so powerful, that it could easily kill dogs much larger than itself. When a dog was cruelly forced into the room where the eagle was kept, it immediately ruffled the feathers on its head and neck, taking a short flight, alighted on the back of its victim, held the neck firmly with one foot, so that there could be no turning of the head to bite, while one of the flanks was grasped with the other, and in this attitude the eagle continued, till the dog, with fruitless cries and struggles, expired. The beak, hitherto unemployed, was now used to make a small hole in the skin; this was gradually enlarged, and from it the eagle tore away and devoured the flesh.



MARIE DELEX SEIZED AND CARRIED AWAY BY AN IMMENSE EAGLE.

Ebel relates that a young hunter in Switzerland, having discovered an eagle's nest, killed the male, and was descending the rocks to capture the young ones, when, at the moment he was putting his hand into the cleft to take the nest away, the mother, indignantly pouncing upon him, fixed her talons in his arm, and her beak in his side. With great presence of mind, the hunter stood still; had he moved, he would have fallen to the bottom of the precipice; but now, holding his gun in one hand, and supporting it against the rock, he took his aim, pulled the trigger with his foot, and shot the eagle dead. The wounds he had received confined him to his bed, however, for six weeks. A somewhat similar story is related of the children of a Scottish peasant, who were surprised, in their endeavor to take away some young eaglets from the nest, by the return of the mother, from whose indignation they had great difficulty in escaping.

A peasant, with his wife and three children, took up his summer quarters in a cottage, and pastured his flock on one of the rich Alps that overlook the Dranse. The eldest boy was an idiot, about eight years of age; the second, five years old, but dumb; and the third, an infant. One morning the idiot was left in charge of his brothers, and the three had wandered to some distance from the cottage before they were missed; and, when the mother found the two elder, she could discover no trace of the babe. A strange contrast was presented by the two children; the idiot seemed transported with joy, while his dumb brother was filled with consternation. In vain did the terrified parent attempt to gather from either what had become of the infant. But, as the idiot danced about in great glee, laughed immoderately, and imitated the action of one who had caught up something of which he was fond, and hugged it to his breast, the poor woman was slightly comforted, supposing that some acquaintance had fallen in with the children, and taken away the babe.

A Happy Rescue.

But the day and the succeeding night passed without any tidings of the lost one. On the morrow the parents were earnestly pursuing their search, when, as an eagle flew over their heads, the idiot renewed his gesticulations, and the dumb boy clung to his father with frantic shrieks. Now the dreadful thought broke upon their minds that the infant had been carried off by a bird of prey, and that his half-witted brother was delighted at his riddance of an object which had excited his jealousy.

Meanwhile, an Alpine hunter had been watching near an eyrie, hoping to shoot the mother-bird, on returning to her nest. At length, waiting with the anxious perseverance of such determined sportsmen, he saw her slowly winging her way towards the rock, behind which he had taken

refuge, when, on her nearer approach, he heard, to his horror, the cries of an infant, and then beheld it in her frightful grasp. Instantly his resolve was made, to fire at the eagle the moment she should alight on the nest, and rather to kill the child than leave it to be devoured. With a silent prayer, arising from his heart of hearts, he poised, directed, and discharged his rifle; the ball went through the head or breast of the



VULTURE ON HIS MOUNTAIN CRAG.

eagle; with indescribable delight he bore the babe away; and, within four-and-twenty hours after it was missed, he had the satisfaction of restoring it—with wounds which were not serious, on one of its arms and sides—to its transported mother's bosom.

The flight of the bald eagle, when taken into consideration with the ardor and energy of his character, is noble and interesting. Sometimes



SEA EAGLE AND ITS CAPTIVE.

the human eye can just discern him, like a minute speck, moving in slow curvatures along the face of the heavens, as if reconnoitering the earth at that immense distance. Sometimes he glides along in a direct horizontal line, at a vast height, with expanded and unmoving wings, till he gradually disappears in the distant blue ether. Seen gliding in easy circles over the high shores and mountainous cliffs that tower above the Hudson and Susquehanna, he attracts the eye of the intelligent voyager, and adds great interest to the scenery. At the great Cataract of Niagara, the world's wonder, there rises from the gulf into which the Fall of the Horse-Shoe descends, a stupendous column of smoke, or spray, reaching to the heavens, and moving off in large black clouds, according to the direction of the wind, forming a very striking and majestic appearance. The eagles are here seen sailing about, sometimes losing themselves in this thick column, and again reappearing in another place, with such ease and elegance of motion, as renders the whole truly sublime.

High o'er the watery uproar, silent seen,
Sailing sedate in majesty serene,
Now midst the pillared spray sublimely lost,
And now, emerging, down the rapids tossed,
Glides the bald eagle, gazing, calm and slow,
O'er all the horrors of the scene below;
Intent alone to sate himself with blood,
From the torn victims of the raging flood.

Audubon describes a bald eagle pursuing a swan, as follows: The next moment, however, the wild trumpet-like sound of a yet distant but approaching swan is heard: a shriek from the female eagle comes across the stream; for she is fully as alert as her mate. The snow-white bird is now in sight; her long neck is stretched forward; her eye is on the watch, vigilant as that of her enemy; her large wings seem with difficulty to support the weight of her body, although they flap incessantly. So irksome do her exertions seem, that her very legs are spread beneath her tail, to aid her in her flight. She approaches; the eagle has marked her for his prey. As the swan is passing the dreaded pair, the male bird starts from his perch, in full preparation for the chase, with an awful scream.

Flight Like a Flash of Lightning.

Now is the time to witness a display of the eagle's powers. He glides through the air like a falling star, and, like a flash of lightning, comes upon the timorous quarry, which now, in agony and despair, seeks, by various maneuvers, to elude the grasp of his cruel talons. It mounts, doubles, and willingly would plunge into the stream, were it not prevented

by the eagle, which, long possessed of the knowledge that, by such a stratagem, the swan might escape him, forces it to remain in the air, by attempting to strike it with his talons from beneath. The hope of escape is soon given up by the swan. It has already become much weakened, and its strength fails at the sight of the courage and swiftness of its antagonist. Its last gasp is about to escape, when the ferocious eagle strikes with his talons the under side of its wing; and, with unresisted power, forces the bird to fall in a slanting direction upon the nearest shore.

And, again, when two of these eagles are hunting, in concert, some bird which has alighted on the water, this writer says: At other times, when these eagles, sailing in search of prey, discover a goose, a duck, or a swan, that has alighted on the water, they accomplish its destruction in a manner that is worthy of our attention. Well aware that the waterfowl have it in their power to dive at their approach, and thereby elude their attempts upon them, they ascend in the air, in opposite directions, over the lake or river on which the object which they are desirous of possessing has been observed. Both reach a certain height, immediately after which, one of them glides with great swiftness toward the prey; the latter, meantime, aware of the eagle's intention, dives the moment before he reaches the spot. The pursuer then rises in the air, and is met by its mate, which glides toward the water bird that has just emerged to breathe, and forces it to plunge again beneath the surface, to escape the talons of this second assailant. The first eagle is now poising itself in the place where its mate formerly was, and rushes anew, to force the quarry to make another plunge. By thus alternately gliding, in rapid and often-repeated rushes, over the ill-fated bird, they soon fatigue it, when it stretches out its neck, swims deeply, and makes for the shore in the hope of concealing itself among the rank weeds. But this is of no avail; for the eagles follow it in all its motions; and the moment it approaches the margin, one of them darts upon it.

The Sea Eagle.

In the genus *haliaetus* belong the fishing or sea eagles, the best known and largest of which is the white-headed eagle. The length is about three feet, and the extent of wings seven feet; the female is somewhat larger. Its usual food is fish, but it eats the flesh of other animals, when it can get it and often seizes quadrupeds and birds of inferior flight, and when pressed by hunger will feed on carrion. The flight of this bird is very majestic; it sails along with extended wings and can ascend until it disappears from view, without any apparent motion of the wings or tail;



FISH EAGLE WITH BROOD OF YOUNG.

and from the greatest height it descends with a rapidity, which can scarcely be followed by the eye. The power of wing is not more remarkable than the consummate skill with which the strong pinions are made to cut the air.

These birds live to a great age. They are generally seen in pairs and the union seems to last for life. The attachment of the old birds to their young is very great. The breeding season commences about March and though each male has but one mate during its entire life, many and fierce are the battles, which arise about the possession of these spouses.

The Osprey or Fish Eagle.

The white-tailed sea eagle of Europe, called also osprey, is distributed over the northern portions of the Old World. It feeds principally on fish, and when unable to obtain fish, on sea birds, young seals, and any small animals which it can surprise. The length from the point of the beak to the end of the tail is about two feet, and the expanded wings measure somewhat more than five feet.

The wings, when closed, reach beyond the end of the tail. The head is small, and is brown or black, with white at the top. The upper parts of the body and the whole of the tail are brown, and the breast is white. It is a singular circumstance in the formation of this bird that the outer toe turns easily backward, so as on occasion to have two of the toes forward and two backward, and it has a much larger claw than the inner one. This, and the roughness of the whole foot underneath, are well adapted for the securing of its prey.

A Sudden Plunge.

During the spring and summer months the osprey is frequently seen hovering over the rivers for minutes without visible change of place. It then suddenly darts down and plunges into the water, whence it seldom rises again without a fish in its talons. When it rises in the air it shakes off the water and pursues its way towards the woods. The bald eagle which, on these occasions, is generally on the watch, instantly pursues the osprey, whereupon the latter drops the fish. The former immediately pounces at this prey and never fails to catch it before it reaches the water, leaving the osprey to begin its work afresh. Sometimes the osprey will fight with the other for its rightful property, and though generally conquered in the end, a fight of this sort has been kept up for upwards of half an hour.

The Harpy Eagle.

The harpy eagle is of the size, power, and fierceness of the true eagles. It has a crest of numerous broad, black feathers on the back part of the head, which is raised by excitement and depressed in tranquillity. The

back and wings are brownish-black, each feather terminating in a narrow streak of lighter shade ; the under surface is pure white ; its wings are short, its legs and talons robust, its general aspect severe and savage, with something of the gloomy expression of the owl. It inhabits



RAVENOUS HARPY EAGLE.

Mexico and the northern portions of South America. It preys on sloths, monkeys, fawns, and other quadrupeds, and especially the young ones. One of the species, which was being carried to England, killed and

devoured a king-vulture which was in the same cage. After its arrival a cat was put into the cage, and this it struck with its foot, instantly breaking its back. It has been known to break a man's skull by a stroke of its powerful bill.

D'Orbigny tells of one which, having been pierced entirely through the body by two arrows of the Indians, still fiercely attacked the persons around him, and was finally dispatched with difficulty. This formidable species inhabits the edges of forests, and is particularly fond of seeking its prey along the banks of rivers; it seems not to fear man, but allows his approach with an air of defiance.

The Short-Winged Tyrant of the Forest.

The shortness of the wings of the harpy eagle, when compared with those of the golden eagle of Europe, and their rounded form and breast, though well adapting them for a continued steady flight, render them less efficient as organs of rapid aerial evolutions than those of the latter, but as it inhabits the woods and does not prey upon birds, but upon animals incapable of saving themselves by flight, its powers of wing are in accordance with the circumstances as to food and locality under which it is placed.

The harpy is the crested, crowned tyrant, and destructive South American eagle. Its length is from two and a half to three feet and the spread of the wings five to six feet. Its general color is dark brown above and white below. The feathers of the breast are very long and loose. It lives in the dark forests of inter-tropical America, especially near the borders of great rivers, and preys on sloths, monkeys, large birds and on young deer and other quadrupeds of that size.

If the harpy eagle soars not aloft, hovering over plains and mountains, it threads the woods, and with unerring aim, strikes its defenceless victims. Death seems the work of an instant; the strongest of these animals, powerless in his grasp, is clutched and expires. Strong as are the talons of the golden eagle, great as is the muscular development of its limbs, and formidable as are its claws, they seem almost trifling compared with those of the harpy eagle. It is interesting to compare the skeletons of these birds. The bones of the harpy are in thickness more than double that of the golden eagle, and the enormous size of the talons is sufficient to convince the observer of the ease with which this fierce bird could bury its claws in the vitals of its prey. In its native regions the harpy eagle is by no means common. It is eagerly hunted by the natives, who consider the feathers of this bird as their proudest decorations.

CHAPTER XV.

CHARMING CREATURES OF THE AIR.

Beauty of the Bird of Paradise—Strange Guesses—"A Heavenly Residence"—Flying Against the Wind—Method of Capturing the Paradise Bird—Rising Above the Gale—Plumage of Wonderful Elegance—Bird Seen in a Mirror—Fastidious Creature—Pride of Feathers—Pretty Hedge-Sparrow—Great Pains in Building a Nest—Fine Singers—Nightingale Learning the Hedge-Sparrow's Song—Discovery of the Lyre-Bird—Singular Form of Tail—Graceful Appearance—Swift Runner—Sudden Break in the Music—Savages Decorated with Superb Feathers—The Swift Swallow—Ingenious Aërial Oars—Long Flights—Extraordinary Migrations—Guesses by Scientific Men—"When the Swallows Homeward Fly"—Argus Pheasant—Size and Color—A Beauty of Sumatra—Plumage Decorated with a Hundred Eyes—Short Life in Captivity—Old Birds with Gay Feathers—Story of Cræsus and Solon—"Golden-Flower Fowl" of China—Far-Flying Albatross—Expert Fisher—Nest Built up on the Ground—The Plumed Crane—Milton's Description—Story of William the Conqueror—Habits of Crane Family—Ludicrous Vanity of a Crane—Dweller in Tree-Tops.



THE birds of paradise have great diversity of beauty. Some of them have thinly-barbed feathers to cover the closed wing, so prolonged as to form immense tufts, and extending far backward beyond the body. The most fanciful conjectures have been entertained in reference to the habits of these birds. By some they have been regarded as inhabitants of the air, living only on the dew of heaven, and never touching the surface of this terrestrial sphere; and others, while believing they never rested on the ground, have considered that they subsisted on insects. Some have ranked them among the birds of prey, and others—including Buffon—asserted that they had no feet, and could neither walk nor swim, and were incapable of any other means of progression except by flight.

Some little mystery beclouded the views of many, in consequence of the fact that the people of the islands where the bird of paradise was first obtained have paid little regard to the study of natural history. The fact is, that its legs being large and strong, and neither ornamental nor required in the skins made up for general commerce, were cut off; while the natives, thus concealing what they regarded as a deformity, considered themselves entitled to augment their demands when they offered the bird for sale. The purchaser of it in civilized countries naturally inquired for the legs of which it was destitute, and the seller began to think that it could

have none. Having arrived at this satisfactory conclusion, it was a necessary inference that a bird without legs must live in the air, which would render them unnecessary; the extraordinary beauty of the plumage added to the deception, and as it was considered to have "heavenly beauty," it was thought also to have a "heavenly residence." In accordance with this view its name was given, and the false reports which have been propagated on the subject have thus arisen. Hence Linnæus and the older writers styled the bird *apoda*, or footless, although the man who introduced the bird to scientific observation in Europe distinctly stated that it was in no prominent respect different from other birds.

Paradise Birds in the Air.

The true residence, or breeding-place, of these birds seems to be Papua, or New Guinea, whence they make occasional excursions to some smaller neighboring islands. They fly in flocks of about thirty or forty, led, it is alleged, by a single bird, which the natives call their king, but which is said to be of a different species. It is further pretended, that when this bird settles the whole flight settle also, in consequence of which they sometimes perish, being unable to rise again, owing to the peculiar structure of their wings. They also always fly against the wind, lest their plumage should be discomposed. While flying they make a noise like starlings, but their common cry rather resembles that of a raven, and is very audible in windy weather, when they dread the chance of being thrown upon the ground. In the Aru islands they are seen to perch on lofty trees, and are variously captured by the inhabitants, with bird-lime snares and blunted arrows. Though many are taken alive, they are always killed immediately, embowelled, the feet cut off, the plumed skins fumigated with sulphur and then dried for sale. The Dutch ships frequenting the sea between New Guinea and Aru, a distance of about twenty miles, not unfrequently observe flocks of paradise birds crossing from one to the other of these places, but constantly against the wind. Should a gale arise, they ascend to a great height, into the regions of perpetual calm, and there pursue their journey. With respect to their food, we have little certain information from the older authors, some of whom assert they prey on small birds, a supposition which is favored by their strength of bills and legs, and the vigor with which they act in self-defence. They are said also to feed on fruits, berries, and butterflies.

Plumed Bird of Graceful Flight.

A recent account of these birds in a state of nature is given by Lesson.

The birds of paradise, he says, or at least the emerald species live in troops in the vast forests of the Papuans, a group of islands situated under



ROYAL BIRD OF PARADISE.

the equator, and which is composed of the islands Arou, Wagiou, and the great island called New Guinea. They are birds of passage, changing their quarters according to the monsoons. The females congregate in troops, assemble upon the tops of the highest trees in the forest, and all cry together to call the males. These last are always alone in the midst of some fifteen females, which compose their seraglio, after the manner of the gallinaceous birds.

Colored Plumage of Surprising Elegance.

Soon after our arrival at this land of promise (New Guinea) for the naturalist, I was on a shooting excursion. Scarcely had I walked some hundred paces in those ancient forests, the daughters of time, whose sombre depth was perhaps the most magnificent and stately sight that I had ever seen, when a bird of paradise struck my view: it flew gracefully and in undulations; the feathers of its sides formed an elegant and aerial plume, which, without exaggeration, bore no remote resemblance to a brilliant meteor. Surprised, astounded, enjoying an inexpressible gratification, I devoured this splendid bird with my eyes; but my emotion was so great that I forgot to shoot at it, and did not recollect that I had a gun in my hand till it was far away.

One scarcely has a just idea of the paradise birds from the skins which the Papuans sell to the Malays and which come to us in America. The people formerly hunted the birds to decorate the turbans of their chiefs. They kill them during the night by climbing the trees where they perch, and shooting them with arrows made for the purpose, very short, which they make with the stem of the leaves of a palm. The campongs, or villages of Mappia and of Emberbakène are celebrated for the quantity of birds which they prepare, and all the art of the inhabitants is directed to taking off their feet, skinning, thrusting a little stick through the body, and drying it in the smoke. Some more adroit, at the solicitation of the Chinese merchants, dry them with the feet on.

It is at the rising and setting of the sun that the bird of paradise goes to seek its food. In the middle of the day it remains hidden under the ample foliage of the teak-tree, and comes not forth. He seems to dread the scorching rays of the sun, and to be unwilling to expose himself to the attacks of a rival.

Bennett, in his "Wanderings," gives the following account of a bird of paradise which he found in an aviary at Macao, where it had been confined nine years, exhibiting no appearance of age:

This elegant, beautifully colored creature has a light, playful, and graceful manner, with an arch and impudent look; dances about when a

visitor approaches the cage, and seems delighted at being made an object of admiration; its notes are very peculiar, resembling the cawing of the raven, but its tones are by far more varied. During four months of the year, from May to August, it moults. It washes itself regularly twice daily, and, after having performed its ablutions, throws its delicate feathers up nearly over the head, the quills of which have a peculiar structure, so as to enable the bird to effect this object. His food during confinement is boiled rice mixed with soft egg, together with plantains and living insects of the grasshopper tribe; these insects, when thrown to him, the bird contrives to catch in his beak with great celerity.

Passionate Pride of Dress.

I have observed the bird, previously to eating a grasshopper given him in an entire and un mutilated state, place the insect upon the perch, keep it firmly fixed with the claws, and, divesting it of the legs and wings, devour it, with the head always placed first. He rarely alights upon the ground, and so proud is the creature of his elegant dress, that he never permits a soil to remain upon it, and may frequently be seen spreading out his wings and feathers, and regarding his splendid self in every direction, to observe whether the whole of the plumage is in an unsullied condition. He does not suffer from the cold weather during the winter season at Macao, though exposing the elegant bird to the bleak northerly winds is always very particularly avoided.

The sounds uttered by this bird are very peculiar; that which appears to be a note of congratulation resembles somewhat the cawing of the raven, but changes to a varied scale of musical gradations. A drawing of the bird, of the natural size, was made by a Chinese artist. The bird advanced steadily towards the picture, uttering at the same time its cawing, congratulatory notes; it did not appear excited by rage, but pecked gently at the representation, jumping about the perch, knocking its mandibles together with a clattering noise, and cleaning them against the perch, as if welcoming the arrival of a companion. After the trial of the picture, a looking-glass was brought, to see what effect it would produce upon the bird, and the effect was nearly the same; he regarded the reflection of himself most steadfastly in the mirror, never quitting it during the time it remained before him. When the glass was removed from the lower to the upper perch, he instantly followed, but would not descend upon the floor of the cage when placed so low.

Paradise Bird in His Glory.

One of the best opportunities of seeing this splendid bird in all the beauty of action, as well as display of plumage, is early in the morning,

when he makes his toilet; the beautiful plumage is then thrown out, and cleaned from any spot that may sully its purity by being passed gently through the bill; the short chocolate-colored wings are extended to the utmost, and he keeps them in a steady flapping motion, as if in imitation of their use in flight, at the same time raising up the delicate long feathers over the back, which are spread in a chaste and elegant manner, floating like films in the ambient air.

I never yet, says Bennett, beheld a soil on its feathers. After expanding its wings, it would bring them together so as to conceal the head, then bending it gracefully, it would inspect the state of its plumage underneath. This action it repeats in quick succession, uttering at the time its croaking notes; it then pecks and cleans its plumage in every part within reach, and throwing out the elegant and delicate tuft of feathers underneath the wings, seemingly with much care, and with not a little pride, they are cleaned in succession, if required, by throwing them abroad, elevating them, and passing them in succession through the bill. Then turning its back to the spectator, the actions above-mentioned are repeated, but not in so careful a manner; elevating its tail and long shaft-feathers, it raises the delicate plumage, forming a beautiful dorsal crest, and throwing its feathers up with much grace, appears as proud as a lady in her full ball-dress.

Having completed the toilet, it utters the usual cawing notes, at the same time looking archly at the spectators, as if ready to receive all the admiration that it considers its elegant form and display of plumage demand; it then takes exercise by hopping, in a rapid and graceful manner, from one end of the upper perch to the other, and descends suddenly upon the second perch close to the bars of the cage, looking out for the grasshoppers which it is accustomed to receive at this time.

This bird is not at all ravenous in its habits of feeding, but it eats rice leisurely, almost grain by grain. Should any of the insects thrown into the cage fall upon the floor, it will not descend to them, appearing to be fearful that in so doing it may soil its delicate plumage: it therefore seldom or ever descends, except to perform ablutions in the pan of water placed at the bottom of the cage expressly for its use.

The Hedge-Sparrow or Siskin.

The siskin or hedge-sparrow is a common bird in all the high parts of Europe. They build generally near the extremities of the branches of tall fir trees or near the summit of the tree. They build a nest of small twigs of birch or heath outside, and neatly lined with hair. Their eggs are a bluish white spotted with purple or red. The bird closely resem-



GRACEFUL HEDGE-SPARROWS.

bles the common sparrow in appearance. They are excellent singers and can easily be domesticated. There are about forty species of this pretty little bird which by its gentle ways and its beautiful song has endeared itself to the inhabitants of continental Europe and the British Isles.

A nestling nightingale learnt the notes of a hedge-sparrow that sang near to it, for want of other sounds to imitate; and it was extraordinary to hear the gentle, although agreeable warble of the latter attuned to the full compass and power of the nightingale. The effect was most pleasing, although, of course, not equal to the natural notes of this bird, not one of which he retained. Indeed, many birds are almost entirely imitative, and in default of hearing the parent bird, they borrow notes of others: soft-billed birds always preferring the song of soft-billed birds, and *vice versa*.

The Lyre-Bird.

In the beginning of the present century, a party of rather turbulent Irishmen were sent on a voyage of discovery to New South Wales. The governor hardly knew what to do with them, and he thought the hardships of travelling in an unknown country would cure their restlessness. When they returned, they brought with them a bird which they called a pheasant. Its size was that of a common hen, of a reddish black color, and with strong black legs. It had a crest on its head, but its tail was the most extraordinary part of it. It spread out in the shape of a lyre, and was composed of several feathers of a light brown color, inclining to orange, and shading into silver. The end of each feather was black. The feathers were of a different texture, alternately thin and thick.

The tail has not the dazzling splendor of the peacock, but it surpasses it in beauty of shape. There are, as you see, two large curved feathers, of black and brown striped, that curve into the form of a lyre, and between them are a number of finer and gauze-like feathers that fill up the space and give them a most elegant appearance. Nothing so striking or graceful had been ever imagined, and yet it had been hidden in the wild bushes of Australia from time immemorial.

Of all the birds the lyre-bird is the most difficult to catch sight of, much less to procure. Its large strong feet are made for running, and it is constantly going up and down among the brushwood, from the top of the mountains to the steep and stony gullies below. It carries its tail erect, so that it can come to no danger. It has a loud cry, which may be heard a long way off, and another note, which may be called a song, but which cannot be heard unless you are close by.



QUEENLY LYRE-BIRD.

The naturalist goes through unheard-of toils to catch a sight of the birds. He lies hidden among the brushwood, and hears their loud shrill notes, for days together, without being able to obtain a glimpse of them. Quite determined to do so, he does not give up his point, but climbs along the gullies and ravines, where he has to cling to trees and creeping plants to keep himself from falling.

These are the spots where the birds often resort ; but if so much as a branch cracks, or a stone rolls over, they take the alarm and are gone. Even when the hunter has come up with one of them, he has to crawl among the branches of the trees and remain perfectly motionless. If the bird is not singing, or engaged in scratching for food, it is almost sure to perceive him if he stirs either hand or foot, and it vanishes as if by magic.

It runs with the utmost rapidity, aided by its wings, over rocks or logs of wood, or whatever comes in its way. It does not often fly into a tree, except to roost. It scratches about the ground and the roots of trees to pick up seeds and insects. Its nest is very large, and like that of the magpie. There are twelve or sixteen eggs in the nest, of a white color, with a few light blue spots. The young birds scamper about with the utmost rapidity, and hide themselves amongst the rocks and bushes. In some places, where roads have been cut through the bush, the bird is more frequently seen, and a man on horseback can approach it more easily than when on foot. It seems less afraid of the horse than of the man. Sometimes it is pursued by dogs, that are taught to rush suddenly upon it when it leaps down from its roosting-place in the tree. And sometimes the hunter wears one of the beautiful lyre-like tails in his hat, and keeps it moving about while he hides in the bushes. The bird is taken by surprise at what he supposes to be one of his own species, and comes within reach of the gun.

No Time to be Lost.

Another way is to whistle, or make some unusual sound, upon which the bird will come forth out of curiosity, and allow himself to be seen ; but unless the gun is fired in a moment, he is half way down the valley. Indeed, shooting the lyre-bird is totally different to any other kind of sport, and the most clever sportsman could do nothing unless he understood the nature of the country and the habits of the bird. The native is by far the most expert hunter of any. He likes to deck his hair with the plumage of the lyre-bird, and to glide noiselessly among the bushes with a gun in his hand. So cautious is he, and so silent, that he can always approach nearer to it than any one else, and rarely suffers it to escape.

Besides its running powers, the bird can take very wonderful leaps.

At one leap it can rise ten feet from the ground. Its habits are solitary; but two lyre-birds have been seen at play, chasing each other round and round, and carrying their elegant tails in an upright position. It has also the habit of making a round hillock, on which it comes every day and erects its tail, and tramples the ground, and utters all its notes—sometimes mocking those of other birds, and even making a howling noise like that of the dingo, or native dog.

Besides its loud full call, which may be heard echoing to a great distance, it can sing the little song we have mentioned. The strain is often broken off suddenly, and then resumed again. The nests are sometimes placed on the ledge of some projecting rock, or on the stump of a tree, but always near the ground. One of the nests which was seen by a naturalist was deep, and shaped like a bason, and lined with the bark of trees and fibrous roots.

Man the Foe of the Animal Creation.

“It is much to be regretted,” Mr. Bennet justly remarks, “that human beings are so eager to destroy, even to extermination, the races of animals, useful or dangerous, which may be found in a new country. In the settled parts of a colony, the harmless kangaroos and emus are rarely seen, when they might be easily domesticated about the habitations. The same remark applies to the lyre-pheasant. Why are they not domesticated before, by extermination they are lost to us forever?”

The tail feathers are detached entire from the bird, and are sold in the shops in Sydney in pairs. The price was formerly low, but as the bird has, from being destroyed, as it was not aforetime, become rare, the tails fetch five to ten dollars per pair. About the ranges of the Tumul country, where gun has seldom been carried, they are more frequently seen. Mr. Bennett is our authority for the following particulars:

This bird has its young, like all the wild animals, in the country, and can there be most easily procured. It is heavy in flight, but swift of foot. On catching a glimpse of the sportsman, it runs rapidly, aided by the wings, in getting over logs of wood, rocks, or any obstruction to its progress; it seldom flies into trees, except to roost, and then rises only from branch to branch. These birds build in old hollow trunks of trees which are lying on the ground or in the holes of rocks. The nest is formed merely of dried grass or dried leaves, scraped together. The female lays from twelve to sixteen eggs, of a white color, with a few scattered blue spots.

The young are difficult to catch, as they run with rapidity, concealing themselves among the rocks and bushes. The lyre-bird, on descending,



ARIEL SWALLOWS AND NESTS.

from high trees, on which it perches, has been seen to fly some distance. It is more frequently observed during the early hours of the morning, and in the evenings, than during the heat of the day. It scratches about the ground and the roots of trees, to pick up seeds and insects. The aborigines deck their greasy locks with the splendid tail-feathers of this bird, when they can procure them.

The Swift Swallow.

The mechanism of birds is admirably suited to aid their rapid flight. Their aerial oars, moved by muscles of extraordinary power, easily adapt themselves to all the hazards of their peregrinations through the elevated regions of air. There are animals, as the swallow, for instance, to which flight is so easy that they seem to make a sport of it. A passive force further assists their suspension in the plains of the atmosphere; air, rarefied by the warmth of the body, penetrates into all its cavities and even to the interior of the bones. Rendered thus specifically lighter, like Montgolfier balloons filled with warm gas, they float without effort amid the clouds. Such is the daring flight of those condors which launched themselves from the frozen summits of the Andes towards the sky, and soon disappeared from the sight of D'Orbigny, without one's being able to explain how they could breathe so rarefied an atmosphere.

The bird, though endowed with such a slight frame, nevertheless surpasses in strength the ponderous engines which glide along our railroads. Its vessels and fibres, notwithstanding their wonderful delicacy, work and resist more energetically than our heavy wheel-work and cast-iron tubes; in the one is seen the finger of God, in the other only the genius of man! Launched like an arrow into space, the bird, playing the while, silently clears twenty leagues an hour. A locomotive going at high pressure, enveloped in fire and smoke, attains the same speed only by consuming heaps of coal and water amid the infernal uproar of its wheels and pistons.

Excursions of Hundreds of Miles.

According to Sir Hans Sloane, the sea-mews which nestle on the rocks of Barbadoes take every day a journey over the sea of four hundred miles to amuse themselves and seek for food on a distant island, the industry of the animal thus excelling that of man.

On their adventurous excursions birds follow their track unerringly, guided by sensations of an unknown nature and of extreme delicacy, among which sight and smell play a great part. All historians relate that after the battle of Pharsalia, the putrid emanations from the dead heaped upon the ground attracted the vultures from Asia and Africa,

which came thither to make their repast. It is certain, according to Humboldt, that if a horse or cow be killed in the most solitary passes of the Cordilleras where one might think not even condors could exist, several of these sordid carnivorous birds, attracted by the stench, are soon seen arriving in order to gorge themselves with the putrefied flesh.

The migrations of certain birds are understood; we know whence they start, where they halt, and where they end their journey. Thus, for instance, in autumn, bands of quails which are emigrating, constantly arrive exhausted at the island of Malta, where they meet with fatal hospitality. They are taken in swarms in the streets of the town and on the roads, and as the inhabitants cannot consume the whole of this living harvest, it is sent to distant markets.

Singular Disappearances.

The mysterious emigration of the swallows has particularly occupied the attention of observers. Men could not make out what became of these charming visitors when they suddenly disappeared, and not long ago the strangest suppositions were indulged in on this head.

As these birds in autumn seek their prey in the swamps, and seem to plunge into them, it was for a long time believed that they buried themselves in the mud, only to issue again with the return of the spring warmth, which re-animated them after a six months' asphyxia, or slumber. Olaus Magnus, a northern naturalist, more erudite than observing, was the first who propagated this fable, going so far as to maintain that the Norwegian fishermen often take in their nets a number of swallows along with the fish. It was even asserted that if the poor birds, all soiled with mud, soaked with water, and stupefied with cold, were exposed to the heat of a stove, they were seen to become speedily dry and return to life.

Linnaeus, Buffon, and even Cuvier believed such stories! Ought we to consider this as a reproach on their parts, when we see that some physiologists of our own time obstinately maintain that certain animals can be reanimated?

The idea that swallows winter in the mud of our marshes was so popular, that a German academy thought it advisable to examine whether there was any foundation for the opinion or not. This learned body accordingly proposed to give their weight in silver for all the swallows brought out of the water, but the prize was never claimed. The most astonishing part of the matter is to find Cuvier believing in such a fable. He says, "It appears certain that swallows become torpid during winter, and even that they pass this season at the bottom of the water in the marshes."

As the swallows have for a long time concealed their winter residence, it became the subject of all sorts of conjectures. Some naturalists maintained that, instead of emigrating to distant regions, they hide themselves and become torpid in the depths of some cave, just as the bats do. One of the most reliable of these men, Larrey the surgeon, mentions having discovered in the neighborhood of Maurienne a grotto, the roof of which was lined with a mass of swallows which kept themselves attached to it like a swarm of bees.

But the experiments of Spallanzani have destroyed all these false creeds. The learned abbé found that the swallows which he wanted to throw into a state of hybernation in an ice-house, did not become torpid, but died.

Adanson has taught us that the swallows of southern Europe betake themselves to the Senegal during the cold season. Those which are scattered through adjacent lands unite together at autumn on the shores of the Mediterranean, and when an irresistible desire impels them to depart, cross this sea in numerous troops. Thus then in summer the swallow builds its nest under the sumptuous cornices of palaces, and in winter inhabits the huts of Senegambia.

All do not attain the goal of their pilgrimage. The waves engulf those which have reckoned too much upon their strength, unless some propitious rock or ship happen to be at hand to lend them refuge. During one of my wanderings across the Mediterranean, says Adanson, some strayed swallows happened, when we were mid-way between the two coasts, to fall totally exhausted on the deck of the frigate which was carrying me towards Africa. Every one on board, soldiers and sailors, overwhelmed them with attentions, which they received without exhibiting signs of fear. When they had at last recovered from their fatigues, they recommenced their journey towards the high regions of Senegal, and perchance rested beneath the cabins of savages long ere we had greeted the ports of Algeria.

The Wanderers' Welcome Return.

But after long and perilous journeys these charming visitors of our dwellings return each year with touching fidelity to find their old domicile again. If the rains and winds have injured it, the architects quickly repair it before making it witness of their loves. Spallanzani has even noticed that the feathered couples become strongly attached to their particular nests. Having fixed party-colored ribbons to the feet of some of them, he recognized them the year after, when they came to take possession again. He saw them return thus for eighteen successive summers. How many among us never enjoy such a long tenancy!

Another species of the same group, the ariel swallow, fondly returns to its republic, formed of agglomerated nests, and more ingeniously constructed than those of our swallows. These nests resemble so many wide-necked bottles hung by the bottom in inaccessible places.

The Argus Pheasant.

The pheasants have a short, convex, and strong bill, the head more or less covered with carunculated bare flesh on the sides, which, in some species, is continued upwards to the crown, and beneath, so as to hang under each jaw, and the legs, in most of the species, are furnished with spurs. The females produce many young ones at a brood. These they take care of for some time. The nests of the whole tribe are formed on the ground. The common pheasant is about three feet long, of which the tail forms one-half; the male is bright rufous above, the head and neck blue with green and golden reflections, and variegated with black and white. Its habits are much like those of the common fowl.

One of the prettiest species is the argus pheasant. It is about the size of a common fowl; the under part and lower neck are reddish brown, spotted with yellow and black; the back ochrey yellow with black and brown spots; tail deep chestnut with white spots, surrounded by a black ring; secondaries about three feet long and brownish, but when spread adorned with beautiful oscillated spots, like those in the peacock's tail.

The female is dull chestnut red, varied with yellowish brown and black without the development of the tail feathers and secondaries. It is found in the forests of Sumatra and the other large East Indian islands, where it lives in pairs. The name argus pheasant is derived from the number of eye-like spots with which its wing feathers are covered.

Short-Lived Beauties.

These birds are extremely shy, and very difficult to be kept alive for any length of time after they have been taken from the woods. In a strong light they appear to be dazzled, and when exposed to such, they seem to be melancholy and inanimate, but in the dark they recover all their animation. They have a cry not unlike that of a peacock, and their wings and tail feathers are in considerable request for female head dresses.

Other pheasants are the horned pheasant and Impeyan pheasant (so called in honor of Lady Impey), an inhabitant of Nepaul and the Himalaya mountains, both very beautiful birds.

It is a curious fact that the hen bird, when she is getting old, will often assume the beautiful colors and gay plumage of her mate, and become a sort of natural curiosity. Next to the peacock, the pheasant carries away



BEAUTIFUL ARGUS PHEASANT.

the palm in beauty, both for the lovely color of his plumes, and the happy manner in which they are blended.

There is an old story told about the famous king of Lydia, Cræsus, who was said to be the richest monarch in the world. He was one day seated on his throne, in his royal robes, and in all his magnificence, and asked Solon, the Greek philosopher, if he had ever seen anything so fine. It was rather a foolish question. And Solon replied, that having seen the beautiful plumage of the pheasant, he could not be surprised by any other grandeur that might be displayed before him.

The pheasant, thus grandly attired, is no less admired when served up at the table. His flesh is so delicate that its delicacy once became a proverb, and when a doctor in those days wished to recommend an article of diet, he used to say it was as nice and as wholesome as the flesh of the pheasant.

There are many varieties of the pheasant, such as the spotted pheasants of China, and the gold and silver pheasants, also brought from that country. The daily life of the pheasant is very much like that of the grouse. He loves the thick plantation or the tangled wood, and during the summer and autumn has the habit of sleeping on the ground, though in the winter a tree is chosen on which to roost.

Early in the morning he visits the open fields, and searches for the tender shoots of the grass and of many of the meadow plants, and will pick up worms and insects. Later in the season, acorns, and beech nuts, and wild berries form articles of diet. But during a severe winter the birds require to be fed, or they would suffer from hunger. Then they become very tame, and come when they are called.

The Golden Pheasant.

The golden pheasant is derived from China. Its name there is said by Latham to be "kinki," or "kinker," which signifies "golden-flower fowl." It is a favorite in that country, as may be seen by its frequent occurrence in Chinese paintings.

In our country this bird has hitherto been preserved only in aviaries, where it is shielded from the cold of winter and supplied with food. In captivity it breeds freely. It is one of a race remarkable for beauty.

The golden pheasant is much smaller than the common one. The length of the male is about three feet, of which the tail measures twenty-three inches. The head is ornamented with a beautiful silky crest of a fine amber-yellow. The feathers of the back of the head and neck are of a rich orange-red edged with a line of black, and capable of being raised at will. Lower down, so as to lie on the top of the back, the feathers are

glossy greenish-black. The back is rich yellow ; the wings deep blue at their base, the under surface intense scarlet.

There are four species of albatross, of which three are found principally in the seas of hot climates and the fourth within the Antarctic Circle. In size, these marine birds are sometimes as large as a swan. Their general color is white, the upper parts are marked with black lines. The

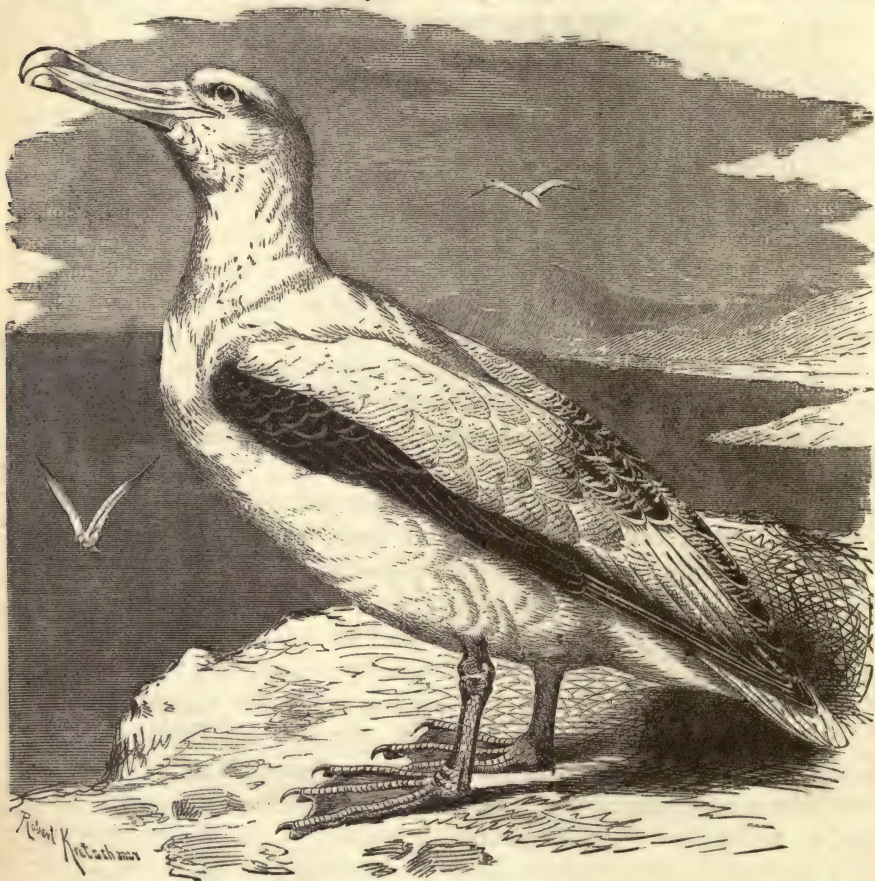


GOLDEN PHEASANT.

quill feathers are black and the tail is rounded and of lead color. The bill is of pale yellow and the legs of flesh color.

The powers of flight of the albatross are exceedingly great ; it is almost always on the wing and is equally at ease during the stillest calm, or flying with great swiftness before the most furious gale. They are very voracious, and feed on fish and mollusks. The shoals of flying-fish

suffer greatly from the voracity of these birds. They also often pursue the shoals of salmon into the mouths of large rivers and so gorge themselves, as, notwithstanding their otherwise extraordinary powers of flight, to be prevented by their weight and consequent stupidity even from rising. They always fish in fine weather and retire into the harbors when the wind is boisterous. Their voice very much resembles the braying of an ass.



WANDERING ALBATROSS.

In South America they build their nests about the end of September; these are formed of earth on the ground and are from one to three feet high. The eggs are as large as those of a goose and have the single property of their white not becoming hard by boiling. When attempted to be seized, the albatross makes a vigorous defense with its bill.

Cranes are found in numerous flocks, in the northern parts of Europe. Linnæus describes their appearance in Lapland, and Pennant says they

also visit Russia and Siberia. The nest of the crane is made among long herbage, reeds, and the luxuriant vegetation of swampy tracts, and sometimes on insulated ruins. Two eggs are laid, of a pale dull-greenish color, blotched with brown. The food of this bird consists not only of grain and vegetables, but worms, frogs, and snails. Cranes are said to make great havoc in the corn when it is green. Of their migration Milton says ·

Part loosely wing the region ; part, more wise,
In common, ranged in figure, wedge their way,
Intelligent of seasons ; and set forth
Their airy caravan ; high over seas
Flying, and over lands with mutual wing
Easing their flight : so steers the prudent crane
Her annual voyage, borne on winds ; the air
Floats as they pass, fanned with unnumbered plumes.

Flocks of these birds are seen, at stated times, in France and Germany, passing north and south, as the season may be, in marshalled order, high in the air, their sonorous voices distinctly heard even from their elevated course. Occasionally they descend, attracted by newly-sown fields, or the prospect of finding food in marshes, on the borders of rivers, or even the shores of the sea ; but generally they continue their flight unchecked towards their destined resting-places.

Willoughby says, "The flesh is very savory and well tasted, not to say delicate ;" and indeed it seems to have been highly prized in former days. Pegge says, "William the Conqueror was remarkable for an immense stomach, and withal was so exact, so nice and curious in his repasts, that when his prime favorite, William Fitz Osborne, who, as steward of his household, had the charge of the curey, served him with the flesh of a crane scarcely half roasted, the king was so highly exasperated that he lifted up his fist, and would have struck him, had not Eudo, who was appointed steward immediately after, warded off the blow." At the enthronization of George Newell, an English archbishop, 204 cranes were served ; and in the "Northumberland Household Book," the price of the crane is marked sixteen pence. At an ancient marriage-feast, one of the items is, "9 cranes, every crane three shillings and fourpence."

Habits of the Crane Family.

Cranes are large birds frequenting marshes and open plains, migrating to warm climates in winter and returning to the north to breed. They fly usually at night in large flocks, following a leader in two diverging lines not unlike ploughshares, at a great elevation and sometimes uttering loud cries. Their food consists of reptiles, fish, mice and other small ani-

mals, insects, seeds, roots and grain. They are very shy and difficult to approach from the acuteness of their sight and hearing. In captivity they become gentle, feeding on vegetable substances.

The crowned or crested crane is slender and graceful, and is often kept in captivity for its beauty and docility ; its voice is remarkably shrill. When the cranes are on the ground they are said to set guards during the night.

The demoiselle crane is remarkable for the idea that it appears to have respecting its own beauty. Its deportment is very singular and at times even ludicrous. It moves about with a consequential air, hanging its head first on one side and then on the other. It then will run some



CRESTED CRANE AND VIRGIN CRANE.

twenty or thirty yards treading only on the tips of its toes, as if it were trying to pick its way over a very dirty road. Then it will have a little dance all to itself and suddenly stand still again quite composed, as if it had been doing nothing at all.

From these habits naturalists have named this bird demoiselle, or peacock crane. Its daily habits are very regular. At sunrise it leaves its resting place in search of prey along the banks of a stream. About two hours later it takes a bath and then amuses itself in the above described manner. Sometimes a short excursion is made in the afternoon, but generally one meal suffices for the whole day. They select their resting place in dense forests on high trees, never on the ground.

CHAPTER XVI.

CURIOUS SPECIMENS OF THE FEATHERED TRIBES.

The Odd-Looking Flamingo—"Bean Pole" of the Bird World—Fiery Plumage—Elegant Appearance—Singular Nest—Remarkable Construction of Jaws—The "Kiwi-Kiwi"—Wingless Creatures—Descendants of the Ancient Dinornis—New Zealand Chiefs Dressed in the Skin of the Apteryx—An Egg that Weighs One-fourth as much as the Bird—Habits of the Apteryx—The Ostrich—Bird of the Desert—Extraordinary Nest and Eggs—Birdlings Hatched by the Sun—Arabian Stories of the Ostrich—Royal Carriage Drawn by a Team of Ostriches—Riding the Two-legged Steed—Cunning Methods of Capture—American Ostrich Described—Noisy Guinea-Fowl—Flesh of Fine Flavor—Conspicuous Crest—Eggs Colored like the Plumage—The Sacred Ibis—Varied Colors—Bird of Mexico—Egyptian Veneration for the Ibis—Regular Migration—Embalmed Remains in Egyptian Burial Places—The Giant Heron—Lonely Creature—Inhabitant of Marshes and Water Courses—Singular Habits—Seeking Prey—Standing for Hours on one Leg—Little Herons—The Heron and Falcon in Combat—The Shoe-Bill—Strangest of all Birds—The Spoon-Bill—A Voiceless Bird—The Owl—Immense Eyes—A Night Prowler—White Owl—Tenant of Barns—Voracity for Mice—The Owl Attacking a Man—Little Birds' Revenge—The Darter—Long Neck—The Famous Stork—Remarkable Intelligence—A Good Wife and Mother—Storks Sentenced to Death for Infidelity—The Adju-tant—Blue-Headed Parakeets.



HERE are few birds so odd in their appearance as the flamingo. Its body is not so large as that of the stork, but its legs are like long stilts. Indeed, they may be said to be quite out of proportion to its size; when it stands up it is six feet high. The head is small, but is furnished with a very long bill, which, as you see, curves down from the middle. The end of the bill, as far as the bend, is black, and then a reddish yellow. The tongue is large and fleshy, and fills up the whole of the bill, and the tip is gristly. Its long legs rather link it with the waders, but the three front toes are united by a web, as in the case of the water-birds.

The plumage of the head, when in its full perfection, is deep scarlet, with black quills. As it strides about upon its stilt-like legs, with its enormous length of neck, we should regard it as a most uncouth creature but for its splendid scarlet robe, that excites our admiration. It lives with its companions in a flock, and the flock stand in a line, like sentinels, clad in their red uniform. One of the band acts as a watchman, and if any danger approaches, utters a scream like the sound of a trumpet. Then

the whole flock rise in the air with loud clamor, and look very much like a fiery cloud.

The creeks and ravines of tropical countries in Asia and Africa abound with flamingoes. They are seen standing, as in the engraving, and pre-



ASIATIC FLAMINGO.

sent a most grotesque appearance. Their way of feeding is very peculiar. They twist their neck in such a way that the upper part of the bill touches the ground, while they disturb the mud with their webbed feet, and raise up the insects and spawn of which they are in search.

In the summer the flock of flamingoes will take a journey northward as

far as the Rhine. When they are on the wing they have a very splendid appearance. They look like a great fiery triangle. All at once they slacken their speed, hover for a moment, and then alight on the banks of the river. They range themselves in the usual line, place their guards, and begin at once to fish.

Considering the enormous length of its legs, you would wonder how the bird contrives to hatch its eggs, or what kind of a nest it builds. It is a mason bird, and forms its nest of mud, in the shape of a hillock, with a hole at the top. Here the mother bird lays two eggs about the size of those of the goose. The nest is high enough to allow her to throw her legs across it and sit upon the eggs, in an attitude as if she were riding. The flamingo sitting on its nest in this manner has been compared to a man on a high stool, with his legs hanging down. The nest itself is very curious, and is solid nearly to the top, and then hollow like a basin.

Flamingoes in the Snare.

The bottom of the nest is in the water, and the bird usually has its feet in the water. In some parts of the tropics, the birds are tamed for the sake of their skin, which is used in swans' down. They are caught in snares, or else decoyed by tame flamingoes that are used on purpose. The tame flamingoes are driven into places frequented by the wild ones, and meat is laid upon the ground. As soon as the wild flamingoes see the others eating the meat, they come forward to obtain a share. A battle ensues between the birds, and the bird-catcher, who is hidden close by, watches his opportunity to dart forward and seize the prey.

There are two kinds of flamingoes—that of America is of a deep red, while the one in Asia and Africa is rose-colored, with black wings. In old times the flesh of the flamingo was considered a dainty, and even now the young bird is thought by some people to taste like partridge. But the people in these days, who have tasted it, say it is very disagreeable.

There was a tame flamingo that lived a little time in our latitude. It used to dip its bread in water, and to eat more in the night than in the day. It was very impatient of cold, and would go so near to the fire as to burn its toes. One of its legs was hurt by an accident, and it could not use it. But it contrived to walk all the same, for it put its head to the ground and used its long neck as a crutch.

As the flamingo frequents the sea-coast and the adjacent marshes, it has the power of swimming, and its toes are partially webbed; and thus it may fearlessly venture even beyond its depth, nor apprehend being carried away by the retiring tide. Its food consists of small fish, shells, and water insects, for the capture of which its beak is most singularly

constructed ; in length it is nearly five inches ; the upper mandible is bent downwards in the middle, at an acute angle, as if broken, the space from the angle to the point being a broad flat plate, of a somewhat oval figure ; the lower mandible, which is the larger, is so adjusted as to fit the angle with its edges, its under surface being gently arched downwards. The edges of both mandibles are furnished with a row of tooth-like eminences, those of the upper being the larger.

The use of the mandibles is like a strainer, allowing the water to pass through, but retaining any small body, as an insect or a fish. In searching for food in the mud, at the bottom of waters, the upper and not the under mandible is applied to the ground ; the flat portion of its surface being well adapted for pressing close down on the soft bed of the marsh or creek. Hence, in that situation, the inferior mandible is placed uppermost, and by its motion works the disturbed and turbid water through the two, as is seen in ducks and other aquatic birds.

The first year the flamingo's livery is of a grayish clouded white ; the second, the white is purer, but the wings are tinted with a beautiful rose-color ; in the third year it attains full plumage. Its color is then extremely rich and brilliant, being of a fine deep scarlet on the back, and roseate on the wings, the quill-feathers of the wings being jet black. The hues of the bird become more intense during succeeding years. A flock of these tall and splendid birds, moving about on the sea-beach, with their plumage reflecting the glowing rays of a tropical sun, is a spectacle never to be forgotten.

The Apteryx or Kiwi-Kiwi.

The apteryx is a native of New Zealand and belongs to the ostrich family. These birds are found in extensive and thick beds of ferns, in which they hide. They are nocturnal and feed on worms, snails, insects and larvæ, run swiftly and defend themselves with their powerful feet. Their name is derived from the apparent absence of wings, those members being merely rudimentary. When hunted by dogs, it seeks refuge among rocks and in the chambers which it excavates in the earth. In these chambers its nest is made and the eggs laid.

The natives hunt it with great eagerness, as the skin is used for the dresses of chiefs, who can hardly be persuaded to part with a single skin. The bird has a singular habit of resting with the tip of his bill placed on the ground. The nostrils of the apteryx are placed almost at the very extremity of the bill. The aborigines of New Zealand give it the name of Kiwi-Kiwi. Their eggs are extraordinarily large and weigh about one-fourth as much as the female bird.



CURIOUS APTERYX OR "KIWI."

Though the apteryx has no wings, yet there are small members growing out of the part of the body from which the wings of birds arise. The feathers are soft and flexible, and furnished with extremely fine hair, so that the covering of the apteryx has, at a distance, exactly the appearance of coarse fur. The length from the point of the bill to the end of the tailless body is about thirty-two inches; but the bill varies greatly in length, and it is supposed that the female has the longer bill. It appears that worms, insects, and probably snails, are the food of this species.

Gould, the naturalist, has become acquainted with several specimens of this bird. He states that its favorite localities are those covered with extensive and dense beds of fern, amongst which it conceals itself, and when hard pursued by dogs, the usual mode of chasing it, it takes refuge in the crevices of rocks, hollow trees, and the deep holes which it excavates in the ground in the form of a chamber. In these latter situations it is said to construct its nest of dried ferns and grasses, and there deposits its eggs.

The natives of New Zealand hunt it for the sake of its flesh, of which they are extremely fond. Until the approach of night it buries itself in the recesses of the forest; and then ventures forth, in couples, in search of food, which they discover in darkness with the greatest ease. The cry of this bird resembles the sound of a whistle, and it is by imitating this that the hunters are able to take it. Sometimes it is chased by dogs, and at others secured by suddenly coming upon it with a lighted torch, when it makes no attempt at flight.

The Richly Appareled Ostrich.

The ostrich, the camel-bird of the Arabs, has been celebrated from the earliest antiquity. It is found throughout Arabia and Africa, everywhere shunning the presence of man and preferring the solitude of the desert. The food of the ostrich consists of the tops of the various shrubby plants which the most arid parts of South Africa produce in abundance. It is so easily satisfied with regard to water, that it is constantly to be found in the most parched and desolate tracts which even the antelopes and the beasts of prey have deserted. Its cry at a distance so much resembles that of the lion, that the Hottentots are said to be sometimes deceived by it.

The male ostrich of South Africa usually associates to himself from two to six females. The hens lay all their eggs together in one nest, the nest being merely a shallow cavity scraped in the ground, of such dimensions as to be conveniently covered by one of these gigantic birds in incubation. An ingenious device is employed to save space, and give at the same time

to all the eggs their due share of warmth. Each one of the eggs is made to stand with the narrow end on the bottom of the nest, and the broad end upwards; and the earth which has been scraped out to form the cavity is employed to confine the outer circle, and keep the whole in the proper position. The hens relieve each other in the task of incubation during the day, and the male takes his turn at night, when his superior strength is required to protect the eggs or the newly-fledged young from the jackals, tiger-cats, and other enemies. Some of these animals, it is said, are not unfrequently found lying dead near the nest, destroyed by a stroke from the foot of this powerful bird.

Remarkable Nest.

No fewer than sixty eggs are sometimes found in and around an ostrich's nest; but a smaller number is more common; and incubation is occasionally performed by a single pair of ostriches. Each female lays from twelve to sixteen eggs. They continue to lay during incubation, and even after the young brood are hatched. The supernumerary eggs are not placed in the nest, but around it, being designed to aid the nourishment of the young birds, which, though as large as a pullet when first hatched, are probably unable at once to digest the hard and acid food on which the old ones subsist. The period of incubation is from thirty-six to forty days. Occasionally the nest is left by all the birds in the middle of the day, the heat of the sun being then sufficient to keep the eggs at the proper temperature.

As to the passage in the Book of Job (xxxix. 14), it may be remarked that within the torrid zone the heat of the sun's rays renders the incubation of the female unnecessary, excepting, perhaps, at night; but in the cooler latitudes she is assiduous in performing the maternal office. In Caffraria, the Rev. J. Broadbent, on approaching an ostrich's nest, remarks:—"We saw the female sitting upon it; and though she had been disturbed before by the Hottentot, she remained till we were very near, and then ran off at the report of two guns which were fired. The ground was sandy for several miles round, and covered with thinly scattered bushes. There lay a great number of loose ostrich feathers about the nest, which appeared to have come off the female while sitting, and she had the naked appearance which domestic fowls have at such times.

,"The eggs were forty-two in number, and were arranged with great apparent exactness. Those which were in the circle we found to be quite fresh, at which I expressed my surprise. The Hottentot informed me that these had been provided for the ostrich against the hatching of those in the middle, when she would break them, one after another, and give

them to her young ones for food ; and that by the time they were all disposed of in this manner, the young ostriches would be able to go abroad with their mother, and provide for themselves such things as the desert afforded. This fact affords a fine instance of animal instinct."

An entire volume might be filled with fables recorded of the ostrich. According to the Arabs, it is the progeny of a bird and a camel. One Arabian author states that it is aquatic ; another maintains that it never drinks ; some that its principal food consists of stones and bits of iron. Buffon himself asserts that it might swallow red-hot iron, provided the quantity was small. Pliny and (following him) Pierre Belon, state that when the ostrich is pursued it fancies itself safe if it can place its head behind a tree, believing that, as it cannot see its pursuers, they cannot see it.

Strange Articles of Diet.

That the ostrich is extremely voracious is certain. Although the senses of sight and hearing are so highly developed that it is said to distinguish objects six miles off, and the slightest sounds excite its ear, the senses of taste and smell are very imperfect. This is the explanation given for its readiness to swallow unedible substances. In a wild state it takes into its stomach large pebbles, to increase its digestive powers ; in captivity it gorges bits of wood and metal, pieces of glass, plaster and chalk, probably with the same object. The pieces of iron found in the body of one dissected by Cuvier "were not only worn away," says the great naturalist, "as they would likely be by trituration against other hard bodies, but they had been considerably reduced by some digestive juice, and presented all the evidence of actual corrosion."

Herbage, insects, mollusks, small reptiles, and even small mammalia, are the principal food of the wild ostrich ; when it is in a state of domesticity even young chickens are devoured by it. It is capable of enduring hunger and thirst for many days—about the most useful faculty it could possess in the arid and burning deserts which it inhabits—but it is quite a mistake to suppose it never drinks, for it will travel immense distances in search of water when it has suffered a long deprivation, and will then drink with evident pleasure.

The muscular power of the ostrich is truly surprising. If matured it can carry a man on its back ; and is readily trained to be mounted like a horse, and to bear a burden. The tyrant Firmius, who reigned in Egypt in the third century, was drawn about by a team of ostriches ; even now the negroes frequently use it for riding.

When it first feels the weight of its rider, the ostrich starts at a slow trot ; it however soon gets more animated, and stretching out its wings,

takes to running with such rapidity that it seems scarcely to touch the ground. To the wild animals which range the desert it offers a successful resistance by kicking, the force of which is so great that a blow in the chest is sufficient to cause death. Verreaux states that he has seen a negro killed by such a blow.

Man succeeds in capturing the ostrich only by stratagem. The Arab on his swiftest courser would fail to get near it if he did not by his intelligence supply the deficiency in his physical powers. "The legs of an ostrich running at full speed," says Dr. Livingstone, "can no more be seen than the spokes in the wheel of a vehicle drawn at a gallop." According to the same author, the ostrich can run about thirty miles in an hour—a speed and endurance much surpassing that of the swiftest horse.

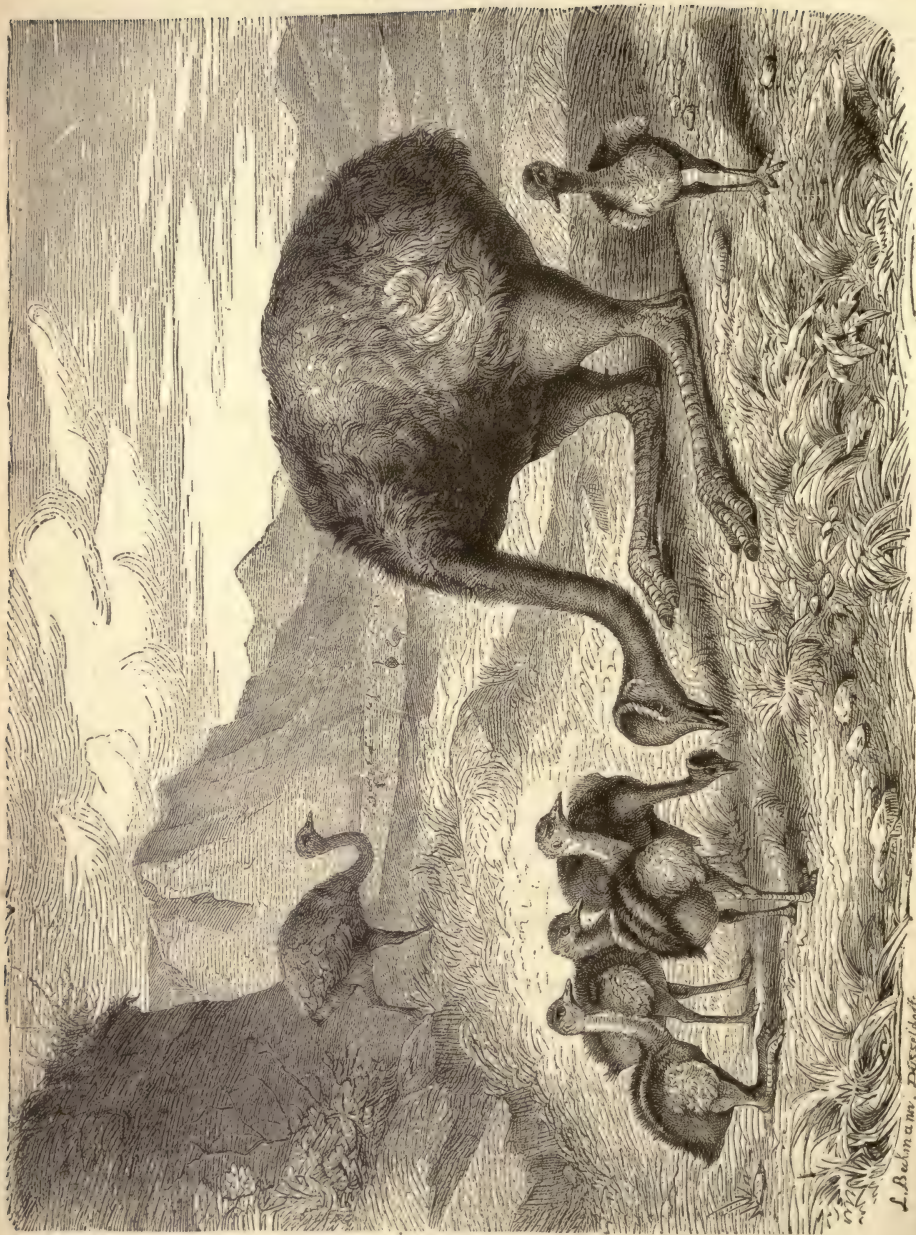
Taking the Ostrich by Artifice.

The Arabs, well acquainted with these facts, follow them for a day or two at a distance, without pressing too closely, yet sufficiently near to prevent them from taking food. When they have thus starved and wearied the birds, they pursue them at full speed, taking advantage of the fact, which observation has taught them, that the ostrich never runs in a straight line, but describes a curve of greater or less extent. Availing themselves of this habit, the horsemen follow the chord of this arc, and, repeating the stratagem several times, they gradually get within reach, when, making a final dash, they rush impetuously on the harrassed birds, and beat them down with their clubs, avoiding as much as possible shedding blood, as this depreciates the value of the feathers, which are the chief inducement of their pursuit.

Some tribes attain their object by a rather singular artifice. The hunter covers himself with an ostrich's skin, passing his arm up the neck of the bird so as to render the movements more natural. By the aid of this disguise, if skilfully managed, ostriches can be approached sufficiently near to kill them.

The Arabs also hunt the ostrich with dogs, which pursue it until it is completely worn out. In the breeding season, having sought and found out where the ostriches lay their eggs, another artifice is to dig a hole within gunshot of the spot, in which a man, armed with a gun, can hide himself. The concealed enemy easily kills the male and female birds in turn, as they sit on their nest. Lastly, to lie in wait for them close by water, and shoot them when they come to quench their thirst, is often successful.

The American ostrich is scarcely more than half the size of the African species, from which it also differs in having the head covered with feathers.



AMERICAN OSTRICH AND YOUNG.

L. Beaman, del.

and the feet furnished with three toes. It is of a nearly uniform gray tint, and the feathers of the wings and tail, although elongated, possess none of the beauty of those of the true ostrich; they are only employed in the manufacture of light dusting-brooms. It is very abundant in the great plains of tropical America, where it is pursued on horseback, and captured either by the lasso, or by throwing at its legs an instrument formed of two heavy balls or stones, attached together by a leathern thong. Mr. Darwin, who had frequent opportunities of observing these birds, says that they take the water readily, and swim across broad and rapid rivers, and even from island to island in bays.

They are said to be polygamous; the male bird prepares the nest, collects the eggs, which are frequently laid by the females at random on the ground, and performs all the duties of incubation. Mr. Darwin confirms these observations, and says that four or five females have been seen to lay in the same nest, and that the male when sitting lies so close that he himself nearly rode over one. At this time the males are said sometimes to be very fierce, and they have been known to attack a man on horseback, trying to kick and leap on him.

Le Vaillant found a female ostrich on a nest containing thirty-two eggs, and twelve eggs were arranged at a little distance, each in a separate cavity formed for it. He remained near the place for some time, and saw three other females come and alternately seat themselves on the nest, each sitting for about a quarter of an hour, and then giving place to another, who, while waiting, sat close by the side of her, whom she was to succeed.

The Guinea-Fowl.

The guinea-fowl is a gallinaceous bird of the turkey family. Guinea-hens are peculiar to Africa, where they frequent woods on the banks of rivers, in large flocks. They feed on grains, grasshoppers and other insects. When alarmed they attempt to escape by running, rather than by flight. The common guinea-hen is slate colored, covered all over with round white spots and is about the size of the common fowl. They are very noisy and troublesome, always quarreling with the other inmates of the poultry yard, and they are hard to raise from the delicacy of the young and their liability to disease.

Their flesh is of fine flavor and their eggs are excellent. They are great feeders, requiring to be fed beyond what they can pick up by themselves, and are apt to injure tender buds and flowers. The crested guinea-fowl or pintado has a crest of black feathers and the body black with blue spots; the mitred pintado has the head surmounted by a conical helmet and is black, white spotted.

The four species of pintado hitherto known are all natives of Africa and of islands adjacent to the African coast. Their mode of feeding is similar to that of the domestic poultry. They scrape the ground with their feet in search of insects, worms or seeds. The females lay and hatch their eggs nearly in the same manner as the common hens. The eggs, however, are



CRESTED GUINEA-FOWL.

smaller and have a harder shell. Buffon states that there is a remarkable difference between the eggs of the domestic guinea-fowls and those which are wild; the latter being marked with small round spots, like those on the plumage of the birds, and the former being, when first laid, of a quite bright red and afterwards of the faint color of the dried rose.

The young birds, for some time after they come into the world, are des-

titute of the helmet or callous protuberance, which is so conspicuous on the heads of the old ones. The guinea-fowl is a restless and clamorous bird. During the night it perches on high places and if disturbed, alarms every animal within hearing by its cry. These birds delight in rolling themselves in the dust for the purpose of ridding themselves of insects.

The Sacred Ibis.

There are about half a dozen species of this wading bird, including three in the United States. The red or scarlet ibis is about twenty-eight inches long, its bill six and one-half inches, and the extent of its wings a little over three feet. This bird, whose color is a uniform bright scarlet, is found in South America and the West Indies. The white ibis, or white curlew, whose plumage is pure white, is very common in the Southern Atlantic and Gulf States, occasionally straggling as far north as New Jersey. Its flesh has a very fishy taste and is rarely eaten except by the Indians.

The glossy ibis, a smaller species, is about twenty-one inches long. Its general color is chestnut-brown, with the back and top of head metallic green, glossed with purple. It exists in great numbers in Mexico and has been found as far north as Massachusetts. Of this genus there are about twenty species found in the warmer parts of Africa, Asia and South America, one of which is the Sacred Ibis of the Egyptians. It is about as large as a domestic fowl, and is found throughout Northern Africa.

This bird, which was reared in the temples of ancient Egypt and was embalmed, frequents overflowed lands and dry plains and feeds on frogs and small aquatic lizards. It is a migratory bird appearing simultaneously with the rise of the Nile and departing as the inundation subsides. It is a remarkable fact, that the ibis does not visit Egypt regularly any more as of old, breeding in the Sudan. As soon as it arrives there it takes possession of its well selected breeding places, from which it undertakes excursions in search of prey. It is not afraid of the natives and can often be seen among the cattle herds picking up a grasshopper here and a frog or lizard there. Dr. Brehm met, on his travels up the Blue Nile, so many of this beautiful bird, that he was able to kill twenty of them within two days. The female lays three to four white eggs of the size of duck eggs. This bird is easily domesticated and is found in many zoological gardens of Europe and America.

In Egypt the ibis was regarded with great veneration by the ancients, who kept them in their temples, and embalmed them after their death; thousands of their remains are still found in the burial places amid the

ruins of ancient Egypt. Various reasons have been given for this custom, some saying that the ibis destroyed the noxious serpents which were so numerous in that country; others that there was supposed to be some analogy between the plumage of the bird and one of the phases of the moon; while a third opinion is that the birds were regarded with favor, because, their annual migration into Egypt taking place at the period of the rising of the Nile, they were considered as the harbingers of that event.

Hérons are found in most parts of the world, migrating to the warmer



THE SACRED IBIS.

regions as winter comes on. They are generally seen alone, standing in swamps, pools and shallow rivers waiting for their prey, with the long neck drawn down between their shoulders; but no sooner does a reptile or fish appear, than the bill is darted forth and the animal immediately swallowed. The common heron of Europe, is of bluish-ash color with a black crest on the hind head and the fore-part of the neck white with black dots. Its food consists of fish, frogs, aquatic insects, mollusks, mice, moles and similar small animals. They generally build their

nest in the vicinity of a river. There exists about a hundred different species of herons. The giant-heron, which is represented in our illustration, is an extremely formidable enemy to the scaly tribes. There is in fresh water scarcely a fish, however large, that the heron will not strike at and wound, though unable to carry it off; but the smaller fishes are his chief subsistence. His method is, to wade as far as he can go, into the water, and then patiently to await the approach of his prey, into which, when it comes within his reach, he darts his bill with inevitable aim. Willoughby says, he has seen a heron that had in his stomach no fewer than seventeen carp.

The heron, as he stands fishing for his food, is the very picture of patience. For some time he has been slowly stalking about on his long legs, watching for his prey. Now he approaches stealthily into the water, laying down one foot after another with the utmost caution. He does not want to alarm the fish that may be swimming merrily about, or the little fry that is sporting playfully in among the stones. He does not want either of them to know that he is there. He will stand thus for hours, until you hardly know whether he is alive.

Suddenly, however, the happy moment comes. The fish that had perhaps caught sight of him and swam away, has forgotten his fright; and the fry that lay hidden under the stones feel sure he must have gone by this time. But they do not understand the nature of their enemy. Nothing can weary out his patience or make him forget. The moment the victim comes within the right distance, down goes the bill with its sharp edge, and the prey is seized and devoured. He has an excellent appetite, and can devour more in a meal than one would believe. When he has finished eating he goes away into some quiet place, and stands on one leg for hours. He may be called the prince of the wading birds.

Hérons place their nests among the tall reeds, at some distance one from the other, and only a few feet above the high-water mark. The nest is large, and made of sticks, without any lining, and is quite flat. The eggs have rather a thick shell, and are of a light blue green color. Both birds sit on the eggs, which take a month to hatch.

A Solitary Bird.

Before we leave this bird we must say a few words about the night herons that live in the cedar swamps. The cedar swamp is perhaps the most dismal spot you can imagine. The ground underfoot is like a bog, covered with great bushy limbs and logs of fallen trees. And the trunks of the cedars grow side by side to the height of two hundred feet, and so close together that a man cannot rush himself between. And there are

no branches, except at the top, where the trees are all matted together, so as to shut out daylight.

Nothing breaks the dreary silence except the chirp of a few birds, or the harsh scream of the heron. And if the wind gets up, the tall stems clash together, and rub one against the other, and make such creaking, and such hideous noises that the effect is something awful.



GIANT HERON.

Every spring the herons come to the cedar swamp, and take possession of their old nests on the cedar trees. All the branches near the place where they live are completely battered and broken down by them, and the ground is strewn with feathers, and fishes, and pieces of old nests, and all kinds of rubbish. And we can hardly describe the noise,

for it is enough to deafen you. They keep repeating the note "quaqua," until the Indian gives them the name of "qua-birds."

The little herons are some time before they know how to fly, but they soon begin to crawl about the branches, and get to the top of the tree to look out for their parents. They are terribly afraid of being caught, and if by chance any one comes that way—and the Indian thinks young heron as nice as pigeon—they scramble out of the way as fast as they can, and hide themselves in the mud.

The Heron's Enemies.

The herons are birds of passage, and their going and coming depend on the supply of food they can obtain. They build their nests in companies, like the rooks, in lofty trees, in the neighborhood of streams and rivers, and such places are called heronries. They are very fond of the society of the ravens, although the ravens often return their friendship by carrying off their eggs. The falcons and the weasels are also great enemies to the young birds. The heron leaves the care of hatching the brood to his partner, but when this task is over he assists in providing the family with food. When the young birds are strong enough to get their own living, the parents drive them away, and they take each a separate course, and begin the world on their own account.

There are still many heronries in different parts of Europe in the grounds of noblemen, where some stream meanders through the domain.

In one of these places, a heron was standing as usual, patiently waiting for his prey, when a fine large eel came insight. Down went the prong-like bill of the heron, but, in his eagerness, he plunged it too near the head of the eel. The long, snaky body was left at liberty, and it twisted itself round and round the neck of the bird until it strangled him. The heron was found the next day, dead on the bank, with the eel, also dead, twisted round his neck. The owner of the mansion had the two creatures, just as they were, preserved as curiosities, and as such they are still to be seen.

In the winter fish are not so plentiful, and the heron has to be satisfied with frogs and snails and worms, and even the duck-weed that floats upon the pond. At these times he becomes very thin and poor, and is nothing but feathers and bones.

Old-Time Sport with the Heron and Falcon.

In the old days of falconry, hawking the heron was considered the highest feat that could be accomplished. The powerful wings of the bird enabled it to rise so high that it put the powers of the falcon to the test. That was the time when the herons were preserved with the utmost



THE STRANGE SHOE-BILL.

care, and the heronries watched over and provided with every necessary. There are old heronries still to be found in ancient parks.

The young heron soon becomes tame, and gets reconciled to captivity, but the old ones pine away and die. In the old days, however, and when the heron had to be procured in order to train the hawk to fly at him, he was crammed with food like a turkey. Often, after this had been done, the bird would become tame, and follow his owner about for miles, and come when he was called, and take food from his hand.

In most cases the bill of the fishing bird is lined towards the point with bristles. The bristles point backward, so that the food can slip easily over them, but it cannot come back without being caught on the bristly hooks. There is no crop at all, and the food goes at once into the stomach. The throat of the heron has the power of stretching out when it gulps down a fish too big for it. It stretches into a fan-like shape, and then comes back again when the fish has gone down.

The Shoe-Bill.

The most singular bird of Africa and even of the whole globe is probably the shoe-bill. It has a bulky body, a thick neck, a large head and a curiously formed bill, not unlike a clumsy wooden shoe. Its color is an ashy gray, with jet black wing feathers.

The shoe-bill is the giant of the wading birds and is found in pairs or smaller societies as remote as possible from human habitations, mostly in the impenetrable swamps of the White Nile and some of its tributaries. At the approach of man it flies away, and when frightened by shots it rises to a great altitude and never returns to its swamp as long as there is any suspicion of danger. This bird selects for its breeding place a small elevation in the reeds, either immediately on the border of the water or in the swamp, mostly where surrounding water renders an approach difficult. One of this family is similar to the foregoing.

Aquatic Spoon-Bill.

The spoon-bill has its name from the spoon-like manner in which both the upper and the lower parts of its bill terminate. It is in other respects like the stork and the heron, and lives upon the same food. They are birds of passage. They spend their summer in Holland, and then pass into Italy or even Africa for the winter. Their nests are made of reeds bound together by weeds, and are in the middle of the river, only a few inches above the surface of the water. The nest is not lined, and is just large enough to allow the mother bird to sit on the eggs, while her partner stands beside her. Sometimes they build on high trees, and, indeed, prefer it.

They feed on fishes and insects and shrimps, and other such diet; but

if pressed with hunger, will eat almost anything. The whole of the plumage of the spoon-bill is pure white, except a band of feathers in the front of the neck that is a buff color. It has a beautiful plume of feathers on its head. Its legs and toes and claws are black; and the toes are connected by a membrane. The beak is black, except at the rounded part, where it is yellow.



SNOW OWL AND SCREECH OWL.

There is a curious fact about the spoon-bill that must not be passed over. It is one of the very few birds that possess no organ of voice, and it cannot utter a single note. There is an entire absence of those muscles that can contract and dilate the air-tubes by which the voice is formed and uttered; in some birds these are like a musical instrument and enable them to pour out their songs.

Much in the same manner as moths differ from butterflies, do owls differ from the falcons. The owls are nocturnal and pursue their prey in the night; the falcons flying altogether in the day time. They feed principally on small birds and quadrupeds and on nocturnal insects. Their eyes are so constructed that they are able to see much more distinctly in the dusk of the evening than in the broad glare of sunshine. All animals by the contraction and dilation of their eyes have in some degree the power of shutting out or admitting light as their necessities require; but in the owl this property is observed in a singular perfection and in addition to this there is an irradiation on the back of the eye, which greatly aids their vision in the obscure places they frequent.

In winter owls retire into holes in towers and old walls and pass that season in sleep. There are about fifty species, of which twenty are furnished with long feathers surrounding the openings of the ears and called horns. In their general mode of life the owls may be considered as the cats of the feathered tribe. The snow owl has a very small round head; about the eyes the feathers are ranged as if proceeding from a common centre in the middle of the eye. The plumage of these owls is very elegant. The legs are of a beautiful yellow hue, the bill jet black and the tongue is cleft.

Pursued by Angry Owls.

The owl is one of the birds that is very rarely seen. The reason is because of his secluded habits and his dislike to facing the light. It must be something unusual that can bring him out in the day-time.

A gardener was once working in a garden when he heard a very strange noise from the top of a tree. As he was very expert, he climbed up to see where the noise came from, and what it was that made it. When he got half way up the tree, two fierce white creatures dashed out and attacked him with beak and claws, making at the same time a terrible screaming. They were, as the intruder soon found to his cost, a pair of owls taking care of their young in a nest at the top of the tree; and an owl in a passion is no pleasant object to meet with. The man hurried down as fast as he could, but he had some difficulty in keeping off the owls. In spite of the daylight, they darted at him again and again, wheeled round his head, and even pursued him, much scratched and frightened, to the very door of his retreat.

But, as a rule, the owl lies very safe and snug in his roost, and does not stir till twilight. He is a very curious bird, and we must spend a few minutes in making rather a close acquaintance with him. He is a bird of prey, for he hunts mice and rats, and even small birds if they

chance to be about in the twilight. His feet are formed on purpose to grasp the prey. The toes are feathered; the first toe is the shortest, and the fourth toe is longer and can be turned backwards. The claws are long and curved, and very sharp.

The plumage is very fine and soft. The eyes of the owl are very large,



SHARP-BILLED DARTER OR SNAKE BIRD.

and the circle of feathers round them reflects the light upon them as a reflector does upon a lamp. But the worst of it is that these large eyes take in more light than the owl can bear. In the day-time he is blinded by the excess of light. This makes him appear as if he were stupid, and he blunders about as though he had lost his senses.

The little birds hate the owl, for he pounces upon them whenever he can. It is fine sport to them if, by any mistake, the owl chances to be abroad in day-time. They soon find it out, for one tells the other, and there is an uproar at once. It is never generous to take advantage of a defenceless enemy ; but the little birds do not think of this. They have many wrongs to revenge, and they fly at his face, and even peck him, taking care, however, to keep away from his claws, and they scold, and drive him about to their hearts' content. As a rule, he does not try to defend himself, but flutters dizzily about, and stares with his great eyes. But if he stops and turns round upon them, the rabble rout at his heels take to flight in a moment.

But the eyes of the owl, though they do not help him much in the day-time, are of the utmost service in the twilight. He can see the smallest speck on the ground, or the tiny mouse in the corner of the barn. And the farmer rather likes him on this account. One barn owl is as good, and will do as much work, as a dozen cats. But as there is no rule without an exception, so there are owls that can see by daylight. The snowy owl is one of these.

His flight is noiseless, like that of the other owls, but he can continue on the wing for a long time. Sometimes he hunts in the air. He spies a pigeon or a wild duck, and he sets himself to follow it. With his swift and steady flight he soon gains upon it. Then he strikes it with his talons, a little in the same manner as the hawks do.

He loves the margin of rivers or streams, and if there is a rapid, or a waterfall, he is all the better pleased. There he stations himself, for plenty of fish are sure to be drawn over, and then he pounces upon them. He also goes to a trap in which some small animal, such as the rat, is caught, and devours it. His diet consists also of larger prey, such as hares and squirrels, and his meals are excessive. You would wonder how his stomach could hold the amount of food put into it. But, happily, it has the power of stretching out like india-rubber, which exactly suits him. He is considered a bird of ill omen, and few people like to meddle with him.

The Long-Necked Darter.

The darters have a small head and a very long slender neck. Their bill is long, straight and sharp-pointed and at its base are the nostrils, situated in a long conspicuous fissure. The face and skin are bare of feathers. The four toes are short and webbed together. Two species are found in America and the third in Ceylon and Java. They live almost entirely on fish which they take by darting forward their bill.

The most apparent and remarkable part of its body is the long and slender neck, which is constantly in motion except during flight, when it becomes immovable and extended and forms with the tail a straight and horizontal line. The principal food of the darter is fish, which, if small enough, it swallows entire, but if they are too large, it flies off with them to some rock or stump of tree, where fixing them under one of its feet, it tears them to pieces with its bill. It generally builds its nest on rocks or trees, but always so near to the river, that it can in case of danger precipitate itself into it. They are very cunning and sagacious when surprised in water. Their head, which is the only part exposed, disappears the instant the hunter approaches, and if missed once it is in vain to think of approaching them again, as they never show themselves again, except for the moment necessary for breathing.

The Renowned Stork.

There are several species of storks, the most important being the white stork. It measures about forty inches in height; length to end of tail, forty-two inches; wings, extended, seventy-six inches; its plumage is white; the wings are fringed with black. This is the species best known in Europe. Holland and Germany are its favorite residences; and Alsace is the part of France in which they are most frequently met with. It is so rarely seen in England that there it has become almost a matter of legend. It is very common in the warm and temperate parts of Asia. In the month of August it leaves Europe to visit Africa, whence it returns in the following spring. This migration is not caused by temperature, as the stork can bear severe cold. It is a mere question of sustenance; for, feeding as it does principally upon reptiles which remain in a complete state of torpor during winter, it is naturally compelled to seek its food elsewhere.

The stork is of a mild nature, and is easily tamed. As it destroys a host of noxious creatures, it has become a useful helper to man, who, not ungrateful, gives it succor and protection. In ancient Egypt it was venerated on the same score as the ibis; in Thessaly there was a law which condemned to death any one killing these birds. Even at the present day the Germans and Dutch esteem it a fortunate omen when a stork selects their house for its home, and they even furnish it with inducements to do so by placing on their roofs a box or wheel, which forms a foundation for the bird to build a nest, which it constructs of reeds, grass, and feathers.

Playful Pet of the Household.

When the stork has attached itself to a place, and is kindly treated, it sometimes gives up the habit of migrating. It cannot however, quite get

rid of agitation when the season for departure comes. Occasions have been known where it yielded to the appeals of its wild companions, and was allured away to join the band of travellers. But this separation is only temporary; next year the truant returns to the old house, and again takes possession of its domicile. It exhibits great pleasure in renewing acquaintance with former friends, and is not long in placing itself on a footing of familiarity with them. It frolics with the children, caresses the parents, plagues the dogs and cats—in a word, manifests a gaiety and susceptibility of affection which one would hardly expect to find in a bird generally dull and taciturn. It presents itself at the family meals, and takes its share of them. If its master tills the ground, it follows him step by step, and devours the worms which are turned up by the spade or the plough.

The stork may certainly be taken as a model for all mothers. Its love for its progeny sometimes even approaches heroism. We will give two touching instances: In 1536 a fire broke out in the city of Delft, in Holland. A stork, whose nest was placed on one of the burning buildings, made at first every effort to save its young. Finally, seeing its inability to assist them, it suffered itself to be burnt with the loved ones rather than abandon them. In 1820, at another fire at Kelbra, in Russia, some storks, when threatened by the flames, succeeded in saving their nest and offspring by sprinkling them with water, which they brought in their beaks. This last fact proves to what extent intelligence may be produced under the influence of parental love.

The Stork a Good Wife.

The stork is not only a good mother, but she is also an excellent wife. The attachment which these birds show for each other when they are once paired has long procured for them a high reputation for conjugal fidelity. Thus, in the Tyrol, a male stork was known to have refused to migrate, passing several winters by the side of his mate, which, in consequence of a wound in her wing, was unable to fly.

We must, however, add that some lady storks are by no means slow in consoling themselves for the loss of their husbands. A few days of mourning, as a matter of form, and their grief ends. Sprungli notes the case of one widowed stork which contracted new bonds after two days. Another gave evidence of the most guilty perversity. The lady began by betraying the confidence of him with whom she had united her destinies; his presence had evidently become insupportable to her, and she finally killed him with the help of her accomplice.



THE GIGANTIC ADJUTANT.

These errors of the female render the high morality of the male bird more conspicuous. Witness the following story, related by Neander:—

A number of storks had taken up their abode in the market-town of Tangen, in Bavaria. Perfect harmony reigned in every family, and their lives were passed in happiness and freedom. Unfortunately, a female, who had been up to that time the most correct of matrons, allowed herself to be led away by the idle gallantries of a young male; this took place in the absence of her mate, who was engaged in seeking food for his family. This guilty intimacy continued until one day the male, returning unexpectedly, became convinced of her infidelity. He did not, however, venture to take the law into his own hands. He arraigned her before a tribunal composed of all the birds at the time assembled for their autumnal migration. Having stated the facts, he demanded the severest judgment of the court against the accused. The unfaithful spouse was condemned to death by unanimous consent, and was immediately torn in pieces. As to the male bird, although now avenged, he departed to bury his sorrows in the recesses of some desert, and the place which once knew him afterwards knew him no more. The French naturalist, Figuier, quotes the foregoing remarkable statement made by Neander.

Jealousy Demanding Revenge.

The storks of the Levant manifest a still greater susceptibility. The inhabitants of Smyrna, who know how far the males carry their feelings of conjugal honor, make these birds the subject of rather a cruel amusement by placing hens' eggs in the nest of the stork. At sight of this unusual production the male allows a terrible suspicion to gnaw his heart. By the help of imagination, he persuades himself that his mate has betrayed him; and in spite of the protestations of the poor thing, he delivers her over to the other storks, which are attracted by his cries, and the innocent and unfortunate victim is pecked to pieces. This feature in its character has not a little contributed to the universal estimation the stork is held in.

The stork species called the adjutant, inhabits India; they feed on reptiles and all kinds of filth, and this fact has been the means of securing for them the goodwill of the people. In the large cities of Hindustan they are as tame as dogs, and clear the streets of every kind of garbage which litters them. At meal-times they never fail drawing themselves up in line in front of the barracks, to eat the refuse thrown to them by the soldiers: their gluttony is so great that they will swallow enormous bones. At Calcutta and Chandernagore they are protected by law, which inflicts a fine of ten guineas on any one killing one of these birds.

The long white feathers, celebrated for their delicacy and airiness, which

are used in the adornment of ladies' bonnets, and known in commerce by the name of marabou feathers, come from this bird and the African marabou. Consequently, in spite of their ugliness, a good many are reared in a domestic state in order that our fair ones may obtain their favorite decoration.

The blue-headed parakeet, not larger than a common sparrow, is only found in Borneo, Sumatra, Banka, and in the southern part of Malakka.



BLUE-HEADED PARAKEETS.

Its plumage is a bright green, with a dark ultramarine-blue spot on top of the head, a triangular yellow spot on the back, a scarlet-red, elliptical spot on the throat and some yellow and black wing and tail-feathers. They are very graceful and lively little birds and are easily domesticated; their pleasing manners and gentle disposition rendering them great favorites.

CHAPTER XVII.

MARVELOUS CREEPING ANIMALS.

Reptiles of Antiquity—Animal Curiosities—Fangs of Deadly Poison—Strange Mode of Breathing—Historic Chameleon—Shooting Tongue—Changing Colors—Two Animals in One—A Creature Asleep on one Side and Awake on the Other—Five-Toed Geckos—Curious Suction Foot—Nimble Running on Smooth Surfaces—Tongue like a Dart—The Common Iguana—South American Reptile—Pouch Under the Jaw—Hunting the Iguana—Lizards for Breakfast—Darwin's Description of the Iguana—The Sea Guana—Attachment of Male for Female—A Gallant Defender—Capital Swimmers—Bellowing Bull-Frogs—Frogs Giving First Idea of Electric Telegraph—Housed in Winter Quarters—Stories of the Domesticated Frog—How a Frog Disappeared and what Became of Him—Wonderful Horned-Frog—The Mysterious Salamander—Old Notions about a Creature that could Resist Fire—Human Clothing that will not Burn—Land Tortoises—Finely Colored Shells—Remarkable Longevity—Elephantine Tortoise—How the Tortoise Feeds—Astounding Surgical Operation—Value of the Tortoise Shell—The Tun Snail—A Creeping Oddity.



IN acquaintance with reptiles may be traced backwards to a very remote period. The sacred Scriptures, especially those of the Old Testament, have numerous passages alluding to them; and the ancient monuments of the Egyptians prove that the great groups of the tortoises, the lizards, the serpents, and the frogs were well known to that people. Those forms of animal life must, therefore, have attracted attention from the earliest times; while a natural desire to ascertain which of them were dangerous must have led to particular inquiry, in order to solve the doubt. It is evident, moreover, from the ancient writings of Athenæus, as well as of Herodotus, the father of history, and the contemporary of the prophet Malachi, that notions not merely vague but precise were entertained respecting many species of reptiles.

Reptiles form, unquestionably, a most remarkable class of animated beings. Some are of strange and uncouth aspect, and others, resplendent with burnished hues, glitter like steel and gold amidst the rays of the sun; not a few are strong and ferocious, and of all it may be said they supply abundant materials for interesting and instructive examination.

These creatures teem within the tropical latitudes. They tenant alike the land and the ocean; some prefer the river and the morass; while many are arboreal in their habits, flitting from spray to spray, and from leaf to leaf, in chase of insects. Reptiles swarm in sandy deserts, among dense

and tangled brushwood, in humid forests, and in pestilential swamps; they colonize the ruins of ancient towns and cities, palaces and temples, and often lurk unsuspected in the dwellings of men.

In the more temperate latitudes of the globe the number of these animals is greatly diminished; none are terrible from their size, and very few are to be dreaded for their poison. Passing still farther northwards, a few species remain which are harmless, while one or two besides, though furnished with poison-fangs, are capable only of destroying creatures of small size or a weak frame. The viper of Northern Europe is the representative in our latitude of the numerous deadly snakes which infest the countries of the tropics; and the harmless common ringed snake takes the place of the mighty python of Java and Bengal.

Localities where Reptiles are Frozen Out.

Advancing to the countries of the polar circles, we cannot find the snake, the lizard, the toad, or the frog. The low state of the temperature, the condition of the land and the water, and the deficiency of snails, insects, and other small animals, their usual food, combine to exclude reptiles from these desolate regions.

We may remark at the outset that reptiles, like birds, spring from an egg. The great marine tortoises, for example, come every year, at their appointed times, to deposit their eggs in the sand on the shores of the sea and banks of rivers, near strands of gentle declivity. There the females hollow out a sort of rude, but strong vaulted nest or oven, as it may be termed, wherein the eggs may have the benefit of the concentrated rays of the sun, so as to enjoy an equable heat, as in the instance of eggs under a sitting hen, but under circumstances which do not permit the body of the mother to impart the necessary warmth. The shell of these eggs is generally solid, and their form globular, or of a short cylindrical shape, equally rounded at the extremities. A female turtle will lay as many as a hundred at one time.

The reptiles differ from other animals in the mode of their respiration. Mammals breathe by expanding the cavity of the chest occupied by the lungs, into which, accordingly, the air enters, through the trachea, or windpipe, to fill up the vacuum occasioned by the dilation of the cavity. Now, this action supposes a certain degree of mobility in the walls of the chest, or, in other words, of the ribs and sternum, or breast bone, which encircle it, independently of the action of the diaphragm—the great muscle of respiration, which parts the chest from the abdominal cavity; but in tortoises the walls of the chest are immovable; they cannot be expanded; the bones are all locked into one solid mass, and there is no diaphragm

parting the cavity occupied by the heart and lungs from that containing the rest of the viscera. There must, therefore, be a peculiar mechanism by which the lungs become filled, and this is clearly discoverable.

If we watch a frog, for instance, we cannot readily discover that it breathes at all, for it never opens its mouth to receive fresh air, and there is no motion of the sides to indicate that it respire; and yet, on any sudden alarm, the animal may be observed blowing itself up, as if by some internal power, though its mouth continues all the while to be closed. The throat, however, may be observed in frequent motion, as if it were economizing its mouthful of air, and transferring it backwards and forwards between its mouth and the lungs; while, if we look to the nostrils, a twirling motion may be noticed at each movement of the jaws; for it is, in fact, through the nostrils that the frog receives all the air it breathes.

A Creature Strangled by Opening its Mouth.

The jaws are never opened but for eating; and the sides of the mouth form a sort of bellows, of which the nostrils are the inlets, and by their alternate contraction and relaxation the air is swallowed, and forced into the trachea, so as to inflate the lungs. If the mouth of a frog be forcibly kept open, it can no longer breathe, because it is deprived of the power of swallowing the air required for that function; and if the nostrils be closed, in like manner it is suffocated.

The respiration of most of the reptile tribes is performed in a similar manner. The fact is, that the air is forced by the action of the tongue and mouth through the trachea into the lungs, by an act resembling that of swallowing; or rather, in the manner in which the ball or hollow butt of an air-gun is charged by repeated strokes of the piston.

The tortoises have lungs of great extent, passing backwards under the back-plate, and reaching to the posterior part of the body. Turtles, which are aquatic, derive great advantages from this structure, which enables them to give buoyancy to the body—encumbered as it is by a heavy shell—by introducing into it a large volume of air; so that the lungs, in fact, serve the purpose of a large swimming-bladder. That such was the purpose of this structure is evident from the volume of air received into the lungs being much greater than is required for the sole purpose of respiration.

All reptiles are cold-blooded, sluggish, and inert; subsisting on a scanty allowance of food. The heart of the frog may be regarded as consisting of a single ventricle and a single auricle. From the former there proceeds one great arterial trunk, which is properly the aorta. This soon divides into two trunks, which, after sending branches to the head and neck,



LONG-TONGUED CHAMELEON.

bend downwards, and unite to form a single trunk, which is the descending aorta. From this vessel proceed all the arteries, which are distributed to the trunk and to the limbs, and these arterial ramifications are continued into the great venous trunks.

The heart of the tortoise has two distinct auricles—the one receiving the blood from the pulmonary veins, the other, from those of the body generally; so that the mixture of aërated and vitiated blood takes place, not in the auricle, but the ventricle. When all the cavities are distended with blood, the two auricles being nearly of the same size as the ventricle, the whole has the appearance of the union of three hearts. On a similar plan the circulating system of the serpents is constructed.

The Famous Chameleon.

One character of the chameleon consists in the tongue being cylindrical, worm-like, capable of being greatly elongated, and terminating in a fleshy tubercle, lubricated with a viscid saliva. Another appears in the surface of the skin being covered with horny granules, instead of scales. A third is seen in the deep and compressed form of the body, which is surmounted by an acute dorsal ridge; a fourth, in the tail being round, tapering, and capable of grasping; and a fifth, in the parrot-like structure of the feet, which have each five toes, divided into two opposing sets—three being placed outwardly and two inwardly, connected together as far as the second joint, and armed with five sharp claws.

The head of these animals is very large; and from the shortness of the neck, it seems as if set upon the shoulders. The upper part generally presents an elevated central crust; and a ridged arch is over each orbit to the muzzle. The internal organ of hearing is entirely concealed. The mouth is very wide; the teeth are sharp, small, and three-lobed. The whole of the ball of each eye, except the pupil, is covered with skin, and forms a single circular eyelid, with a central orifice. The furrow between the ball of the eye and the edge of the orbit is very deep; and the eyelid, closely attached to the ball, moves as it moves. As each eye has an independent power of motion, the axis of one eye may be seen directly upwards or backwards, while that of the other is in a contrary direction, giving to the creature a strange and most ludicrous appearance.

The chameleon was once said to live on air; but insects, slugs, and such like creatures form its food. For their seizure its tongue is especially adapted. With the exception of the fleshy tubercle forming its tip, it consists of a hollow tube, which, when withdrawn into the throat, is folded in upon itself, somewhat in the way in which a pocket telescope is shut up. When fully protruded, it reaches to a distance at least equal to

the chameleon's body ; and is launched forth and retracted with equal rapidity. An insect on a leaf at an apparently hopeless distance, or a drop of water on a twig, is gone so instantaneously, that the spectator is astonished. "I never knew," said an acute observer, "a chameleon I long kept miss his aim but once, and then the fly was on the other side of the glass."

Curious Shifting Colors.

The remote cause, says Weissenborn, of the difference of color in the two lateral halves of the chameleon may, in most cases, be distinctly referred to the manner in which the light acts upon the animal. The statement of Murray, that the side turned towards the light is always of a darker color, is perfectly true. This rule holds good as well with reference to the direct and diffused light of the sun, or moon, as to artificial light. Even when the animal was moving in the walks of my garden, and happened to come near enough to the border to be shaded by the box edging, that side (so shaded) would instantly become less darkly colored than the other. Now, as the light in these cases seldom illumines exactly one lateral half of the animal in a more powerful manner than the other, and as the middle line is constantly the line of demarcation between the two different shades of color, we must evidently refer the different effects to two different centres, from which the nervous currents can only radiate, under such circumstances towards the organs situated respectively on one side of the mesial line.

Over these centres, without doubt, the organ of vision immediately presides ; and, indeed, we ought not to wonder that the action of light has such powerful effects on the highly irritable organization of the chameleon, considering that the eye is most highly developed. The lungs are but secondarily affected ; but they are likewise more strongly excited on the darker side, which is constantly more convex than the other.

Notwithstanding the strictly symmetrical structure of the chameleon, as to its two halves, the eyes move independently of each other, and convey different impressions to their respective centres of perception. The consequence is that, when the animal is agitated, its movements appear like those of two animals glued together. Each half wishes to move its own way, and there is no concordance of action. The chameleon, therefore, is not able to swim, like other animals : it is so frightened, if put into water, that the faculty of concentration is lost, and it tumbles about as if in a state of intoxication. On the other hand, when the creature is undisturbed, the eye which receives the strongest impression propagates it to the common centre, and prevails upon the other eye to follow that impres-

sion, and directs itself to the same object. The chameleon, moreover, may be asleep on one side and awake on the other. When cautiously approaching my specimen at night, with a candle, so as not to awaken the whole animal, by the shaking of the room, the eye turned towards the flame would open, and begin to move, and the corresponding side to change color; whereas the other side would remain for several seconds longer in its torpid and unchangeable state, with its eye shut.

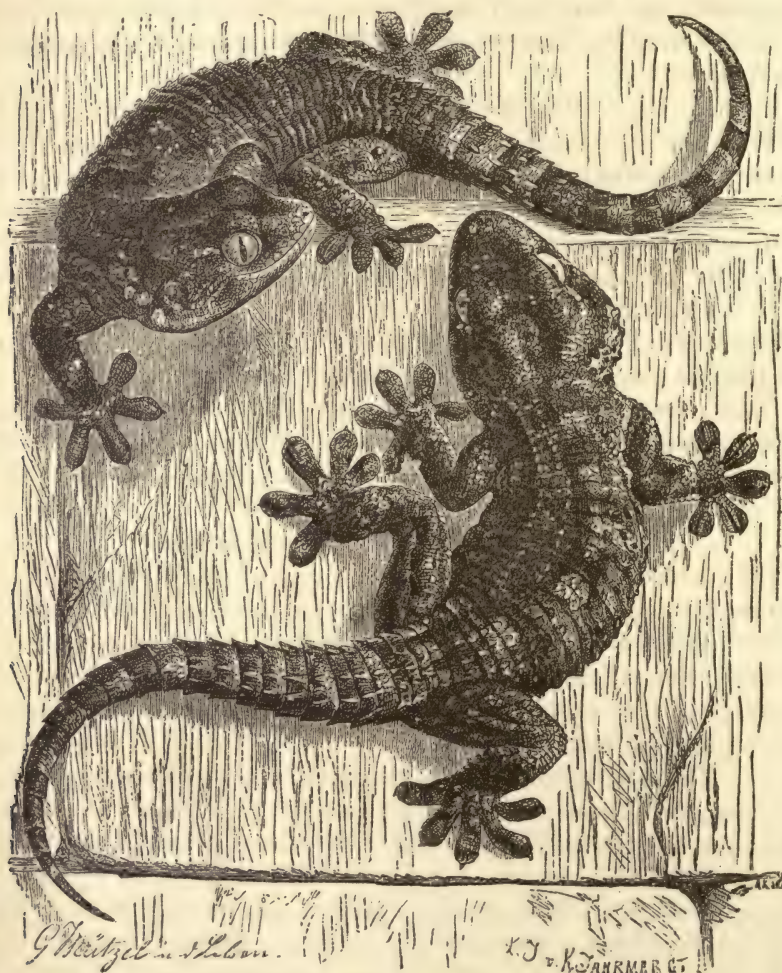
The Geckos or Wall Lizards.

The family standing next to the chameleons is that of the geckos, having characteristics which prevent their being confounded with any other group. One part of their structure may be illustrated by a plaything of the writer's boyhood, which, simple as it was, often conveyed much instruction. It consisted of a piece of leather, about four inches in diameter, having a string with a knot at the end, passed through the centre, which, dipped in water, and pressed down with the foot on a stone, raised it at pleasure from the ground. The reason of its doing so is easily understood. The edges of the wet leather, being closely pressed, stuck so firmly to the surface of the stone, as to resist the force of the string when it was pulled upwards; the consequence was, that a hollow was formed in the middle of the leather which was destitute of air, or what is called a vacuum.

This effect arises from a tendency that exists in all bodies to adhere together, provided the contact of their surfaces is sufficiently perfect—a property which is termed the attraction of cohesion. Were the leather dry, it would not adhere to a rough surface, because the contact could not be rendered sufficiently perfect; but when saturated with water, the interstices of the leather are filled with that fluid, and the inequalities of the surface, which would prevent close contact, are removed. As then the central part is drawn up by the string, the hollow thus produced must necessarily be a vacuum, since the air cannot pass through the leather to supply it; in this state, therefore, the atmosphere presses on the exterior of the leather, and, like any other weight, prevents its rising from the stone—the pressure being equal to fifteen pounds on every square inch of surface. As, however, the atmosphere, by its pressure, ultimately forces its way through the edges of the leather, the interior becomes filled with air; it consequently balances the external weight, which had before confined it, and the stone falls to the earth.

This toy of childhood—the boy's "sucker"—will serve to explain the peculiar mechanism with which the gecko tribe is provided for effecting the adhesion of the feet to the objects to which they are applied. They are, be it observed, nocturnal animals; their food consists of insects, which

they obtain by waiting in ambush for them, or by giving them chase into the holes and crevices to which they retreat for refuge. In pursuing them they traverse the surface of the smoothest substances, pass over the ceilings of rooms, suspend themselves on the under side of a leaf, climb the



FIVE-TOED GECKO OR WALL-LIZARD.

bark of trees, penetrate the cavities and clefts of rocks, and ascend walls; accomplishing all of these extraordinary movements with the greatest facility.

Accordingly, each foot is provided with five toes; all, except the thumb, being terminated by a sharp curved claw. On the under surface of each

toe are sixteen transverse slits, leading to the same number of cavities; these open forwards, and their external edge is serrated, appearing like the teeth of a small-toothed comb. All these parts, together with the cavities, are covered or lined with cuticle. Below them are large muscles, which draw down the claw; and from the tendons of these muscles arise two sets of smaller muscles, situated so as to be put on the stretch, when the former are in action.

By the contractions of these muscles, the orifices of the cavities, to which they belong, are opened, and the serrated edges applied accurately to the surfaces with which the feet are in contact. Thus, as in the boy's plaything, adhesion takes place, and a vacuum is produced, which is terminated at the will of the gecko, by the admission of the air.

For the purpose of seizing the insects, on which it feeds, the lizard darts out with astonishing velocity its forked tongue. This is beset with asperities which are scarcely discernible, but which are of great use in catching its prey. This lizard is capable of existing for a long time without food. Previously to the breeding seasons both female and male change their skins, and this they again do about the beginning of winter. They pass that season in a state of torpor, more or less complete according to the rigor of the climate.

The Singular Reptile Named Iguana.

The common iguana inhabits a great part of South America. These reptiles are easily recognized from the large pouch underneath the neck, and the dentated crest which extends from the head to the extremity of the tail. The tail, feet, and body are covered with small scales. On the upper part their color is a more or less decided green, sometimes becoming blue, at others slate-colored; the lower part is of a yellowish green. The sides present zigzag, roundish, brown scales, edged with yellow; frequently a yellow line is traced obliquely in front of the shoulder, and some specimens are sprinkled with brown; others have the limbs spotted with brown on a black ground. When full grown it attains the length of four feet. They are very gentle creatures, and perfectly harmless, feeding almost exclusively on vegetables. They are hunted for their flesh, which is excellent; and they are most numerous in Surinam and Brazil.

The tongue is curiously used by the animal to draw food into the mouth, and to forward it down the gullet, or to repel it at will, and the only use of the palatal teeth appears to be to secure the food while the tongue moves forward to afford fresh assistance in its journey down the throat. Between the lower jaw and the chest is a pouch, which the ani-



SOUTH AMERICAN IGUANA.

mal draws in or extends simultaneously with the compression or swelling out of the body when enraged or excited. The portion of the pouch attached to the jaw is inflatable, and food is sometimes retained in it for a considerable period.

This iguana is not averse to water, when not too cold, taking to it only when the sun is shining; in fact, not moving about much at any other time. Its mode of swimming differs from that of other lizards, inasmuch as it places its four legs close by the side of its body, and swims entirely with its tail. It dives with great facility, and remains sometimes for a considerable time under water. The tail is a very valuable limb; for, besides being the sole means of swimming possessed by the animal, it is of great use in climbing trees, and it is a more important weapon of defence, a blow from it being frequently sufficient to inflict a severe wound.

Vigorous Use of Teeth and Claws.

In fact, this reptile is rather formidable when brought to bay in the woods. It is hunted by the natives with dogs trained for the purpose. The dog, immediately upon scenting it, gives tongue, and, if on the ground, the dog seizes it by the neck, and either kills it or maims it, which makes its capture easy; if in a tree, the iguana is either shaken down—a matter ordinarily of no small difficulty—or the branch is cut off. It is almost useless to attempt to find these reptiles without dogs, as the resemblance of their color to that of the trees which they inhabit prevents them from being easily seen. Few dogs but those accustomed to the sport will touch them, as, in addition to the blows which they inflict with the tail, they bite and scratch furiously; and when once they lay hold of anything with their teeth, they can only be made to let go by an inducement to bite some more attractive object offered to them. They run into holes when chased, if an opportunity offers, and when their eyes are hidden from view they fancy that their whole body is safely covered. The flesh, particularly of the female, is a great delicacy; it is cooked in various ways, sometimes in a fricassee with the eggs whole, sometimes roasted or stewed. The eggs have a very glutinous consistence.

Within the limited area of the small archipelago of the Gallapagos, situated under the equator about ten degrees west of South America, there are two remarkable species of iguanidæ, of which the habits have been described and commented upon by Mr. Darwin in his volume entitled the "*Voyage of the Beagle*." One of these is particularly so, because, as that naturalist observes, it is the only existing saurian which can properly be said to be a marine animal. In the whole of that group of islands, as he tells us, there is only one rill of fresh water; yet this rep-

tile frequents the sea-beaches, and no other parts of the islands. He adds that it is the only known existing lizard that feeds exclusively on aquatic productions.

The sea-guana according to Darwin, is very common on all the islands throughout the archipelago of the Gallapagos. It lives exclusively on the rocky sea-beaches, and is never found—at least, I never saw one—even ten yards inshore. It is a hideous-looking creature, of a dirty black color, stupid and sluggish in its movements. The usual length of



THE SEA GUANA.

a full-grown one is about a yard, but there are some even four feet long. I have seen a large one which weighed twenty pounds. On the Island of Albemarle they seem to grow to a greater size than on any other. These lizards were occasionally seen some hundred yards from shore swimming about; and Captain Colnett, in his "Voyage," says, "they go out to sea in shoals to fish." With respect to the object, I believe that he is mistaken; but the fact stated on so good an authority cannot be doubted.

When in the water the animal swims with the greatest ease and quick-

ness, by a serpentine movement of its body and flattened tail—the legs, during this time, being motionless and closely collapsed on its sides. A seaman on board sank one, with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterwards, he drew up the line, the lizard was quite active. Their limbs and strong claws are admirably adapted for crawling over the rugged and fissured masses of lava which everywhere there form the coast. In such situations, a group of six or seven of these ugly reptiles may oftentimes be seen on the black rocks, a few feet above the surf, basking in the sun with outstretched legs. I opened the stomachs of several, continued Mr. Darwin, and in each case found it largely distended with minced sea-weed of that kind which grows in thin foliaceous expansions of a bright green or dull red color. I do not recollect having observed this sea-weed in any quantity on the tidal rocks; and I have reason to believe that it grows at the bottom of the sea, at some little distance from the coast. If such is the case, the object of these animals occasionally going out to sea is explained.

The food of this lizard, equally with its compressed form of tail, and the certain fact of its having been seen voluntarily swimming out at sea, absolutely prove its aquatic habits; nevertheless, as we are told by Darwin, there is in this respect one strange anomaly, namely, that when frightened it will not enter the water. From this cause, it is easy to drive these lizards down to any little point overhanging the sea, where they will sooner allow a person to catch hold of their tail than jump into the water. They do not seem to have any notion of biting; but when much frightened they squirt a drop of fluid from each nostril.

Darwin's Experience with a Lizard.

One day I carried one to a deep pool left by the retiring tide, and threw it in several times as far as I was able. It invariably returned in a direct line to the spot where I stood. It swam near the bottom, with a very graceful and rapid movement, and occasionally aided itself over the uneven ground with its feet. As soon as it arrived near the margin, but still being under the water, it either tried to conceal itself in the tufts of seaweed, or it entered some crevice. When it thought the danger was passed, it crawled out on the dry rocks, and shuffled away as quickly as it could. I several times caught this same lizard by driving it down to a point, and, though possessed of such perfect powers of diving and swimming, nothing would induce it to enter the water; and as often as I threw it in it returned in the manner above described. Perhaps this singular piece of apparent stupidity may be accounted for by the circumstance that this reptile has no enemy whatever on shore, whereas at sea it must often

fall a prey to the numerous sharks. Hence, probably urged by a fixed and hereditary instinct that the shore is its place of safety, whatever the emergency may be, it there takes refuge. I asked several of the inhabitants if they knew where it laid its eggs; they said, that although well acquainted with the eggs of the other kind, they had not the least knowledge of the manner in which this species is propagated.

These lizards are very quick in all motions, and climb with astonishing agility. The females are smaller than the males; their appearance is more gentle and pleasing. They are seen gathering along the beach about two months after the end of winter for the purpose of depositing their eggs in the sand of the sea-shore.

A Gallant Defense.

During the spring of the year the male exhibits great attachment towards the female. He defends her even with fury, attacking every animal that seems inclined to injure her, and sometimes fastens his teeth to the enemy so firmly, that it is necessary either to kill him or to beat him on the nose to make him quit his hold. It cannot without difficulty be killed with blows or even by gunshot wounds, but it dies almost instantly if even a straw is put up its nostrils.

These animals are found in a great number on the Galapagos Islands, where they live on the rocks only a few feet distant from the sea. They are excellent swimmers by a snake-like movement of the body and tail, but never using their feet, which are laid closely to the body and never moved. It is a singular fact that when alarmed they seek refuge on the rocks and not in the water, although they are more or less aquatic animals.

Electric Telegraph Suggested by the Frog.

The foot of a frog is often selected for observation in the microscope, as beautifully illustrating the circulation of the blood. It is also worthy of remembrance that Galvani, Professor of Anatomy at Bologna, remarked on one occasion that when the limbs or nerves of a frog were put into communication with the muscles of the thigh, by means of an electric conductor, the limbs were violently convulsed. Thus he discovered a force hitherto unknown, which he called animal electricity. But Volta, another Italian, observing that the effects were far greater when the connecting medium consisted of two different kinds of metals, inferred that the principle of excitation existed in the metals, and not in the nerves of the animal. He therefore argued that by their contact there was developed a small quantity of the electric fluid, which, being transmitted through the organs of the frog, produced the convulsive movements. And



GREAT JUMPING BULL-FROG.

to this conclusion must be traced, among important discoveries, the invention of the electric telegraph.

The tongue of these animals performs a leading part in the capture of the prey. Its structure, in the greater portion of this group, is altogether anomalous, and its insertion is equally at variance with the mode adopted in the other vertebrated animals. It is very soft, fleshy almost throughout, and is not supported at its base by any bony structure.

This organ is provided with a tenacious sticky secretion; and, when it touches the prey, the latter adheres so firmly to it that it is carried back with the tongue into the mouth. There it is, in most cases compressed, involved again in a glutinous sort of saliva, and almost instantly swallowed. The motion of throwing out and returning the tongue is often performed with a rapidity which the eye can hardly follow. The muscles, whose office it is to move the bones, cartilages, and other parts of the mouth, act more especially upon the lower jaw, upon the base of the mandible, and upon the tongue, which, after being shot forth, is returned and swallowed, as it were, with the captured prey, and the act of deglutition is continued till the food is lodged in the stomach.

Going into Winter Quarters.

The frog hibernates, like all our reptiles, passing the colder months of the year in a state of torpor, buried deep in the mud at the bottom of ponds or sluggish streams. There they congregate in multitudes, all huddled closely together, so as to form almost a continuous mass. Early in spring they re-appear, and during the month of March the female deposits her eggs in the water. During summer the frog is very active and voracious, devouring the larger insects, and especially slugs, which are a favorite food. To the gardener or cultivator of culinary vegetables it, therefore, renders special service; and, as Mr. Bell observes, "this consideration ought surely to weigh, even with those who are insensible to the appeals of humanity, in favor of this harmless and much persecuted race."

The sudden appearance of frogs and toads in places where they were not previously seen is not an uncommon occurrence. Violent rains have accompanied their appearance, and such showers have been and still are believed by some to be among the phenomena of nature.

"Naturalists," says Dumeril, "know that the sudden appearance of young frogs on the surface of the earth, and in places where they did not seem to exist previously, has in all times roused public attention and curiosity, the supposition being that they had fallen from the sky. We find, in fact, traces of this belief in Aristotle, in some passages of Athe-

næus and Ælian, and of the moderns, in Gesner; in many volumes of the 'Curious Things of Nature,' in the works of Ray, and those of Redi. Elaborate discussions have been entered into on the subject. Cardan was vigorously attacked by Scaliger, for having given credit to this sort of spontaneous production. Pison thought that these toads did not fall formed from the skies, but that they sprang from the animalizing action of the rain on the clods of fertile earth. He was ably answered by Lentilius."

Trying to Solve a Puzzle.

Redi, admitting the facts to a certain degree, proposed the following explanation:—"These toads and frogs do not appear until it has rained for some time; but these animals had been hatched many days previously; or, rather, having undergone their complete translocation, had quitted the water in which they had been developed as tadpoles. These little frogs, then, lay covered and concealed in the chinks of the earth, under stones and clods, where, in consequence of their lying motionless, and often also on account of their dusky color, they escaped the eye." This is, doubtless, the true state of the case: concealed in fissures and crevices, and exhausted by drought, they lay till the welcome rain restored them to animation, and invited their sudden appearance.

"Dr. W. Roots, of Kingston," says Mr. Bell, "informs me that he was in possession for several years of a frog in a perfect state of domestication. It appears that the lower offices of his house were what is commonly called underground, on the banks of the Thames, that this little reptile accidentally appeared to his servants, occasionally issuing from a hole in the skirting of the kitchen; and that during the first year of his sojourn, he constantly withdrew upon their approach; but on their showing him kindness, and offering him such food as they thought he could partake of, he gradually acquired habits of familiarity and friendship, and during the following three years he regularly came out every day, and particularly at the hour of meal-time, and partook of the food which the servants gave him. But one of the most remarkable features in this artificial state of existence was his strong partiality for warmth, as during the winter months he regularly (and contrary to the cold-blooded tendency of his kind) came out of his hole in the evening, and directly made for the hearth, in front of a good kitchen fire, where he would continue to bask and enjoy himself till the family retired to rest.

There happened to be, at the same time a favorite old domestic cat, and a great deal of intimacy and attachment existed between these incongruous animals; the frog frequently nestling under the warm fur of the cat,

while the cat appeared extremely jealous of interrupting the comforts and convenience of the frog. This curious scene was often witnessed by many besides the family."

Extraordinary Traits of the Bull-Frog.

America has several frogs of huge size and sonorous voice, of which one is the bull-frog. Its croaking sounds are like the bellowing of a bull, and are louder when uttered below the surface. This statement is, probably overcharged. Audubon simply says, its voice is louder than that of any other species, and may be distinctly heard at the distance of forty or fifty yards. He adds: It is particularly fond of such small pure streams of water as are thickly shaded by overhanging bushes. It sits for hours, during the middle of the day, basking in the sun, near the margin of the water, to which it betakes itself by a great leap, at the least appearance of danger, diving at once to the bottom, or swimming to the opposite side. In the Southern States it is heard at all seasons, but principally during the spring and summer months. Its flesh is tender, white, and affords excellent eating. The hind legs, however, are the only parts used as food. They make excellent bait for the larger cat-fish. Some bull-frogs weigh as much as half a pound. I have generally used the gun for procuring them, shooting with very small shot.

A resident at Fort Erie relates that near the town is a deep, muddy creek, with low and marshy shores, and here the bull-frogs are found in great numbers during the summer months. Standing at his own door, he could distinctly hear their sonorous music booming across the water, although the distance was over three miles.

Although naturally shy and timid, he succeeded in taming one, after an intercourse of a couple of months. He was then residing on the banks of a small lake, which was well stocked with various kinds of excellent fish, particularly one sort—those known by the name of "salmon-trout."

During the summer, he says, I used frequently to angle in different parts of the lake for them, and also would place floating lines across some of the convenient bays and inlets. My usual bait was a small live fish to procure which I had to angle with a small hook, baited with a small worm, in the shallower water near the shore. One day, while I was thus employed, I observed a large bull-frog perched upon a prostrate tree, which lay partly immersed in the water. Having caught a sun-fish, just at the moment I first observed the bull-frog—and that sort of fish being the least desirable kind of bait for trout-fishing—without unhooking I swung it as near the frog as practicable. I saw that he anxiously wat

the movements of the fish, and, after some further attempts, I succeeded in placing it within a few inches of him, when he darted quickly upon it, and had it in his capacious mouth in an instant. I then drew him gently towards the small skiff in which I was sitting; but as he approached it he struggled so violently, that he either let go his hold or accidentally lost it, for he disappeared in the water for a few seconds, when I observed his green head close along side of his favorite resting-place, and shortly afterwards he ventured quite out of the water, and took up his original abode.

After this our first interview, I found him daily occupying the same place; and in order to improve our acquaintance, I treated him regularly to a sun-fish breakfast. When our daily intercourse had continued for some weeks, I determined upon taking him prisoner. For this purpose I baited a large hook with a sun-fish, which I threw towards him; and the poor frog, unconscious of any harm, seized it with his usual avidity, when I struck the line somewhat smartly, and found that I had hooked him. I then drew him gently towards me, and, after some fruitless resistance on his part, hauled him into my skiff. He seemed dreadfully alarmed on my laying hold of him, in order to relieve him of the hook and fish, which he had nearly swallowed; and having performed the operation without paining him more than necessary, and having detained him for half an hour, I then permitted him to plunge into his native element.

The Frog Tamed and on Familiar Terms.

I supposed that our acquaintance would probably end here, but no such thing; for on the following morning, when I repaired to my fishing-ground, I found him at his wonted station. I fed him daily as before, and could perceive that he allowed me to approach him much closer, without exhibiting the degree of alarm he had done at first. I one day tied a fish to the line without any hook, and after he had laid hold of it, pulled him quietly into the boat, when he struggled violently, ejected the fish from his stomach, leaped overboard, and swam to his place of refuge. Our intercourse after this became daily more familiar; so that, in the lapse of a few weeks, he would mount upon the flat part of an oar, when I held it close to him, and alight from it in the opposite end of the skiff from where I sat. Thither I would throw him a small sun-fish or two, which he quickly disposed of; after which he would jump overboard, or again mount the flat part of the oar, in order to be handed back to his resting-place.

Soon after this, he would take his accustomed allowance from my hand; at last permitted me to handle him gently, still, however, exhibit-

ing some degree of timidity. After this, I took him across the lake, and confined him in a hogshead, open at both ends, which I placed near the shore, where the water was only about a foot deep. In the centre of the hogshead I placed a stone for him to perch upon, which arose just above the surface of the water. He remained a few days in this confinement, eating from my hand, until one day I found him missing, and concluded he had been devoured by minx or an otter. But on examining the shore for a short distance, I discovered him perched on a decaying log, close to the water's edge. On calling him by the name (Ralph) to which I had lately accustomed him, I thought that he recognized my voice immediately. I took him in my hand without his attempting to escape.

Nicely Caught.

The next morning he again was missing, when I went in search, and found him near the same place as before. I now determined to watch his mode of escaping, for which purpose I hid myself in the bushes close by. I had remained there but a few minutes when I saw him spring over the upper edge of the hogshead into the water. The fact was this, that, from his great muscular strength and agility, he was able, at a single effort, to leap fairly over the top of the cask, which was three feet perpendicular above the top of his supporting stone. On discovering this, I removed the stone, and in its place gave him a floating piece of wood to perch upon, which I found to answer my purpose completely; for upon his making a spring, the perch gave way under the effort; he thereby lost his balance, and all his attempts were unavailing. Having satisfied myself of the practicability of making a domestic pet of a wild bull-frog, I made a present of Ralph to the daughter of a friend of mine, who promised to be kind to him, and to have all his wants cared for. But I afterwards understood that the lake had been visited by a tremendous storm, which had overturned Ralph's prison-house, when, of course, he escaped; but whither, or what became of him, no one could ever tell.

A friend of mine, who lived close to the outlet of a small lake, within a few miles of the scene of Ralph's adventures, used to bestow a great deal of care and attention upon the rearing of young ducklings; but, after all, had the mortification to find his efforts fruitless. The old ones would hatch fine healthy broods; but as soon as they were strong enough to waddle to a sedgy stream that issued from the adjoining lake, one or two daily disappeared, to the great annoyance of my friend. Having suffered those continual depredations for two or three seasons, he one day witnessed a nice young duckling gradually disappear under the water; but judge of his surprise when he beheld a huge bull-frog crawl out upon

the prostrate trunk of a tree, with the duckling's feet still protruding



ARMOR-PLATED FROG.

from his capacious mouth ! The mystery was thus solved ; the bull-frog had swallowed all my friend's young ducks.

The family of frogs pass most of their time in the water, being excellent swimmers; the length of their hind limbs enables them to make considerable leaps and thus travel long distances in search of water. Some species prefer moist localities and damp woods, where they hide under leaves; others dwell in subterranean hollows, which they dig on the borders of marshes, coming forth at evening or on rainy days. All the species, when adult are carnivorous and all are very voracious. Frogs are found all over the globe.

The horned frog is a true batrachian, in which the head is more or less roughened or spiny. It is three times as large as the common frog and has an enormous mouth. An iguanian lizard, which in its general aspect somewhat resembles a frog, and in its sluggishness a toad, is sometimes called a horn-frog; but it is a true lizard and in no respect a batrachian.

The Mysterious Salamander.

This creature, inhabiting Central Europe and the mountainous parts of the south of Europe, is black, with yellow spots, and has numerous prominent warty excrescences on the sides, and the tongue very large. The body of the salamander is largely covered with warty glands, which secrete a milky fluid, of a glutinous and acrid nature, like that of the toad, which, if not capable of affecting the larger and more highly organized animals, appears to be a destructive agent to those of lesser power. Thus, Laurenti provoked two gray lizards to bite a salamander, which at first attempted to escape from them, but, being still persecuted, conveyed some of this fluid into their mouths. One of the lizards died instantly, and the other fell into convulsions for two minutes and then expired. Some of this juice was introduced into the mouth of another lizard; it became convulsed, was paralytic on the whole of one side, and soon died.

Such is the only foundation for the notion so long cherished that the salamander was one of the most venomous of animals. Nicander gives an appalling instance of the symptoms produced by its bite. The Romans looked on it with horror as most destructive, and considered it as deadly as hemlock or aconite. Hence a proverb arose that he who was bitten by a salamander had need of as many physicians as the creature had spots; while another was, "If a salamander bites you, put on your shroud."

But the chief absurdity was the belief that this creature was incombustible—that it not only resisted the action of fire, but extinguished it, and, when it saw the flame, charged it as an enemy which it knew well how to vanquish. Even so late as 1789, Pothonier, the French consul at Rhodes, relates that, while sitting in his chamber there, he heard a loud cry in his kitchen, whither he ran, and found his cook in a horrible fright, who in-

formed him that he had seen the devil in the fire. Pothonier then states

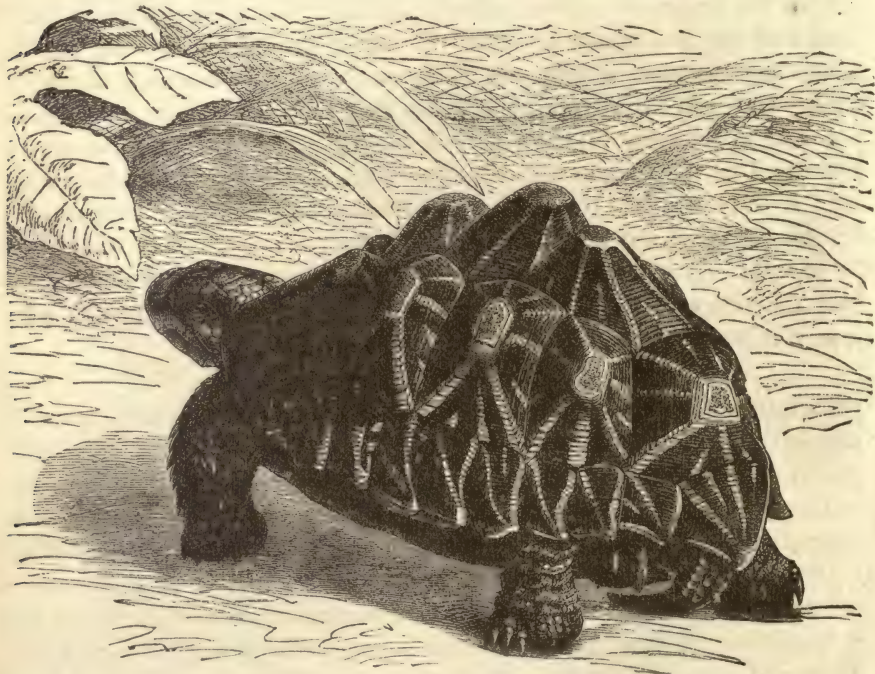


GIANT SALAMANDER.

that he looked into a bright fire, and there saw a little animal, with open mouth and palpitating throat. He took the tongs, and endeavored to

secure it. At his first attempt the creature, which, he says, had been motionless up to that time two or three minutes, ran into a corner of the chimney, having lost the tip of its tail in escaping, and buried itself in a heap of hot ashes. In his second attempt the consul was successful, drew the animal out, which he describes as a small lizard, plunged it into spirits of wine and gave it to Buffon. Pothonier was, doubtless, strongly under the influence of preconceived notions.

A cloth said to be made of the skins of salamanders was declared to be incombustible; but even Marco Polo was shrewd enough to observe that



ELEPHANTINE TORTOISE.

such fabrics were really made of a mineral substance since well known as asbestos. The old writers termed this "salamander's wool;" and such was probably the salamander cloth sent by the Tartar king to the Roman pontiff, in which the so-called "holy napkin" is preserved.

The race of giant tortoises are spread through the hotter and temperate parts of Europe, Asia, Africa, and America. These creatures, in their natural state, lead a quiet, unobtrusive life; wandering, generally, but little from the spot where their existence commenced. The snake darts onwards swift as an arrow, the quick-eyed lizard can scarcely be

seen as it passes; but the tortoise creeps slowly along, and, unable to escape danger by speed, withdraws his head and limbs on the approach of an enemy, and trusts in his natural armor for defence. The density of the shell of the land tortoise is, indeed, very considerable; and the former, from its elevation and convexity, is capable of sustaining, uninjured, a high degree of pressure, thus preserving the internal organs. The plates of horn covering it are often most elegantly marked with alternate raised lines and furrows, and, at the same time, beautifully colored.

Land tortoises, though they never enter the water, are frequently met with in the neighborhood of lakes and rivers. Here vegetation is luxuriant, and the soil moist or soft—the latter circumstance being by no means unimportant; as they dig in the earth holes or burrows, in which, during winter, in extra-tropical latitudes, they bury themselves, and remain in a state of torpidity till the return of spring. It is, also, in holes which they dig that the females deposit their eggs, which are then covered up and left, the warmth of the sun being sufficient to bring them to maturity. Neither the eggs, nor the young ones hatched, are objects of solicitude to the parents. It is remarkable that, like young chickens, tortoises have a hard tubercle at the end of the beak before being hatched, for the purpose, it is fairly presumed, of breaking their prison-shell.

An Old Settler.

Tortoises, in common with cold-blooded animals, whose circulation is languid, are remarkable for tenacity of life. They will not only bear serious injuries without death, but without much apparent suffering. In ordinary circumstances the duration of the life of these creatures is very protracted. We are not sure, indeed, of the period at which, according to the laws of their physical system, they cease to live in their native regions; but we know that even in our uncongenial climate, instances are on record of tortoises attaining to what, compared with the life of man and quadrupeds generally, may be termed a very great age.

Murray, in his "Experimental Researches," in allusion to the Peterborough tortoise, gives us the following interesting particulars:—"From a document belonging to the archives of the cathedral called the 'Bishop's Barn,' it is well ascertained that the tortoise at Peterborough must have been about 220 years old. Bishop Marsh's predecessor in the see of Peterborough had remembered it above sixty years, and could recognize no visible change. He was the seventh bishop who had worn the mitre during its sojourn there. Its shell was perforated, in order to attach it to a tree, and to limit its ravages among the strawberry borders."

Like other oviparous quadrupeds the tortoise can subsist for an amazing length of time without food. They are very tenacious of life. A man named Redi, to prove the extreme vital tenacity of a tortoise, made a large opening in the skull, and took out all the brain, washing out the cavity so as not to leave the smallest particle, and then with the hole open, set the animal at liberty. It marched off without seeming to have received the slightest injury, except closing its eyes, which it never afterwards opened. In a short time the hole closed and in about three days a complete skin covered the wound. In this manner the ani-



THE TUN-SNAIL.

mal lived without any brain for six months, walking about and moving its limbs in the same manner as it had done previously to the operation.

Tortoise shell is the production of the imbricated turtle, a species which is found in the Asiatic and American seas and sometimes in the Mediterranean. The shields of this species are far more strong, thick and clear than those of any other. They are first steeped in boiling water, after which they may be moulded into almost any form.

The family of tun-snails is interesting for various reasons; their shell is round and thin. The mollusk has a large, egg-shaped, thick foot, which can be greatly expanded by admitting a large quantity of water. The head is flat and broad; and they have a large thick trunk.



CHAPTER XVIII.

MONSTROUS REPTILES OF THE TROPICAL WORLD.

The Crocodile—Power of Destruction—The Tyrant of the Tropical Seas—Double Jaws—Teeth and Scales—Egg of the Crocodile—Old Stories of the East—The Crocodile's Little Friend—Danger Signal—A Harpoon Thrust—Swift Swimmer—Deadly Serpents—A Cold-Blooded Bosom Companion—Eastern Snake-Charmers—Coolness Saves a Man's Life—Foolhardy Risk—Gurling Killed—Poison Working with Lightning Rapidity—Venomous Viper—Dancing Snakes—Fascination of Music for Serpents—Death of a Notorious Serpent-Eater—A Disgusting Glutton—Huge Boa—Constrictor—Blind Adoration of the Boa—Lines by Southey—A Monster Swallowing its Bed—Disgorging a Blanket—Vast Size of the Boa—Enormous Muscular Power—Fed to Death—Tree-Snakes with Magnificent Colors—The Slender Whip Snake—Frightful Accident in Guinea—Ghastly Fangs—The Egg-Eater—Immense Throat of a Tiny Creature—Serpents of Surprising Beauty—Queer Popular Superstitions—The Red-Throated Lizard—Hideous *Cristatus*—The Curious Moloch—A Freak in the World of Reptiles—The Pipa Toad—A Creature that Hatches Eggs on its Back—Description of the Batrachians—Death from a Toad—Winter's Sleep in a Bed of Mud.



IF the eagle is the king of the air, the lion the despot of the forest, and the whale the monarch of the deep, the crocodile has for the exercise of his undisputed control the shores of tropical seas and rivers. Living on the confines of land and water, this formidable reptile is the scourge of those human beings who are compelled to reside near its haunts, for it surpasses the tiger, lion, or eagle in its power of destruction.

The teeth are implanted in a single row, and continually maintained perfect by an organic system which ensures their immediate reparation; for each tooth is hollowed at the base in such a manner as to form the cell or sheath for its successor. The new tooth presses on underneath the old one, so that the first is developing while the second is decaying. In some species the front teeth of the lower jaw are so long and sharp that they perforate the edge of the upper jaw and appear above the muzzle when the mouth is closed. Baron Cuvier says, "The lower jaw being continued behind the cranium, the upper one appears to be movable." The mouth is without lips, consequently, whether walking or swimming, their teeth are visible.

This conformation gives the crocodile a terrible and alarming aspect,

increased by its eyes, which are placed obliquely and close together. Its tail is long, tapering, and flat on the sides like an oar; enabling it to direct its course through the water, and swim with rapidity. The skin is coriaceous, thick, and resistant; being covered with plates of different size, according to the parts of the body they protect. On the skull and face the skin adheres to the bone, and there is no trace of scales.

The scales which defend the back and the upper part of the tail are square, and form hard bands possessed of great flexibility, which prevent them from breaking. Down the centre of the back there is a ridge, which adds to the strength of their armor. Thus, nature has provided for the safety of these animals by covering them with a cuirass capable of resisting anything but fire-arms. The plates which cover the belly, neck, tail, and legs, are also arranged in bands, but are less hard, and not crested.

Crocodiles are oviparous. The females of the Nile deposit their eggs where the solar heat soon brings them to maturity. But in certain countries, such as in the neighborhood of Cayenne and Surinam, the eggs are buried under a mound of leaves which the alligators form. This undergoes a kind of fermentation, the result of which is an increase of temperature, which produces the desired result.

Lacépède describes an egg in the Museum of Natural History in Paris, which was laid by a crocodile fourteen feet in length, killed in Upper Egypt. This egg is only two inches and a half in length, and two inches in breadth. It is oval and whitish. Its shell is cretaceous in substance, like the eggs of birds, but not so hard. At the time of birth crocodiles are only about six inches in length, but their growth is very rapid. Seizing water-fowl as they swim on the surface, pursuing fishes in the depths of the lagoon or river, or grasping in its jaws a large animal, as a pig or a dog, on the bank, the crocodile plunges beneath the water in order to drown its victim, and, were its throat open, would suffer great inconvenience; but there is a valve which prevents its occurrence.

Ancient Reverence for the Crocodile.

Strabo tells a strange story of a crocodile he saw when he visited Egypt, about four hundred years after Herodotus was there. "In this district they honor the crocodile very much, and they have a sacred one which lives by itself in the lake, and is quite tame to the priests. He is called Suchos, and is fed with bread, and meat, and wine, which he gets from strangers who come to see him. Our host, who was a person of importance in the place, accompanied us to the lake, taking with him from table a small cake, some roasted meat, and a little cup full of some



FAMOUS EGYPTIAN CROCODILE.

sweet liquor. We found the crocodile lying on the margin of the lake. The priests went up to him, and while some opened his mouth, another crammed into it first the cake, then the meat, and last of all, poured the drink down his throat. The crocodile, after this treat, jumped into the lake, and swam over to the other side."

According to Herodotus, crocodiles are sacred with some of the Egyptians; but are not so with others, who treat them as enemies. Those who dwell about Thebes, and the lake Mœris, look on them as very sacred, and they each train up a crocodile, which is rendered quite tame. Into the ears of these crocodiles they put crystal and gold earrings, and adorn their fore paws with bracelets. They give them appointed and sacred food, treating them as well as possible while alive, and when dead they embalm and bury them in the sacred vaults. But the people who dwell about the city Elephantine eat them, not considering them sacred.

"The crocodile," continues the historian, "is blind in the water, but very quick-sighted on land; and because it lives for the most part in the water, its mouth is filled with leeches. All other birds and beasts avoid him, but he is at peace with the trochilus, because he receives benefit from that bird; for when the crocodile gets out of the water on land, and then opens its jaws, which it does most commonly toward the west, the trochilus enters its mouth and swallows the leeches. The crocodile is so well pleased with this service, that it never hurts the trochilus."

The Crocodile's Little Friend.

This singular story, related also by Pliny, is confirmed by a recent and accomplished writer, Mr. Curzon. "I will relate," he says, "a fact in natural history which I was fortunate enough to witness, and which, although it was mentioned so long ago as the times of Herodotus, has not, I believe, been often observed since; indeed, I have never met with any traveller who has himself seen such an occurrence.

"I had always a strong predilection for crocodile-shooting, and had destroyed several of these dragons of the waters. On one occasion I saw, a long way off, a large one, twelve or fifteen feet long, lying asleep under a perpendicular bank, about ten feet high, on the margin of the river. I stopped the boat at some distance, and, noting the place as well as I could, I took a circuit inland, and came down cautiously to the top of the bank, whence, with a heavy rifle, I made sure of my ugly game. I had already cut off his head in my imagination, and was considering whether it should be stuffed with its mouth open or shut. I

peeped over the bank: there he was, within ten feet of the sight of the rifle. I was on the point of firing at his eye, when I observed that he was attended by a bird called a zic-zac. It is of the plover species, of a grayish color, and as large as a pigeon.

"The bird was walking up and down close to the crocodile's nose. I suppose I moved, for suddenly it saw me, and instead of flying away, as any respectable bird would have done, he jumped up about a foot from the ground, screamed 'Zic-zac! zic-zac!' with all the powers of his voice, and dashed himself against the crocodile's face two or three times. The great beast started up, and, immediately spying his danger, made a jump into the air, and, dashing into the water with a splash which covered me with mud, he disappeared.

The zic-zac, to my increased admiration—proud, apparently, of having saved his friend—remained walking up and down, uttering his cry, as I thought, with an exulting voice, and standing every now and then on the tips of his toes in a conceited manner, which made me justly angry with his impertinence. After having waited in vain for some time, to see whether the crocodile would come out again, I got up from the bank where I was lying, threw a clod of earth at the zic-zac, and came back to the boat, feeling some consolation for the loss of my game in having witnessed a circumstance, the truth of which has been disputed by several writers on natural history."

Curious Danger Signal.

It is also worthy of remark that Hamet, the intelligent attendant on the hippopotamus, when brought to England, said he knew the bird, which he described pretty accurately. A naturalist took him down to the museum in the Zoological Gardens, when he at once pointed out a spur-winged dotterell, or plover, as the bird he meant. This species, it appears, is constantly found in the places where the crocodiles land, and runs about hunting for insects when the crocodiles are lying asleep. The appearance of the hunter immediately excites a noisy note from the plover; the crocodile wakes, and the natives believe that the bird is the crocodile's friend and watchman. The natives of Dongola call it by a name which means the cousin or niece of the crocodile.

The structure of the crocodiles renders it difficult for them to bend their bodies sideways; whence the notion of throwing them out, when in pursuit, by doubling back. There is a story of an Englishman running before a large alligator, which came out of the lake Nicaragua, and was gaining on him fast. He would have been soon overtaken, had not some Spaniards called him to run in a circle, and baffle it by compelling it to

resort to the laborious operation of turning should it be bent on continuing the pursuit.

The crocodile is caught at the present day in Dongola for the sake of the flesh, which is regarded as a delicacy. The most favorable season is the winter, when the animal usually sleeps on sandbanks, enjoying the warmth of the sun; or the spring, after the pairing time, when the female regularly watches the sand island where she has buried her eggs; and on the south side of it—that is, to the leeward—the huntsman, therefore, digs a hole in the sand, throwing up the earth to the side he expects the crocodile to take.

The Crocodile Stabbed to Death.

In this hole he conceals himself, and, should the crocodile fail to observe him, it comes to the accustomed spot, and soon falls asleep. The huntsman then darts his harpoon with all his force at the animal; for, in order that the stroke may be successful, the iron ought to penetrate to the depths of four inches at the least, for the barb to be fixed fast. The crocodile, on being wounded, rushes into the water, and the huntsman retreats to a canoe, with which a companion hastens to his assistance; a piece of wood attached to the harpoon by a long cord swims on the water, and shows the direction in which the crocodile is moving. The huntsmen, pulling by this rope, drag the crocodile to the surface of the water, where it is pierced by a second harpoon.

The iron part of the harpoon is a span long, and formed towards the point like a penknife, being sharp at the end and on the edge. Beyond this edge there is a strong barb, while on the back of the blade a piece projects, to which the rope is fastened. This iron head is affixed to a shaft of wood, eight feet in length. The skill of the harpooner consists in giving the weapon sufficient impulse to pierce through the coat of mail which protects the crocodile. When the crocodile is struck, it lashes violently with its tail, and endeavors to bite the rope asunder. To prevent this, the rope is made of about thirty separate thin lines, not twisted, but simply placed together, and bound at intervals of every two feet. The thin lines get between the teeth, or become entangled round them. It frequently happens that the harpoons, by the pulling of the men, break out of the animal's body, and it escapes.

“If I had not seen the fact with my own eyes,” says Küppell, “I could hardly have believed that two men could draw out of the water a crocodile fourteen feet long, fasten his muzzle, tie his legs over his back, and finally dispatch him, by plunging a sharp instrument into his neck, so as to divide the spinal chord.”

In some of the rivers of Africa the negroes are bold enough, and, indeed, skilful enough, to combat the crocodile in his own element, and, armed only with a sharp dagger, dive beneath him, and plunge the weapon in his body. It often happens, however, that the combat is fatal to the man, and frequently his only chance to escape is to force his dagger, or, if this be lost, his thumbs, into the animal's eyes with all his might, so as to produce great pain and blindness.

An Arrow in the Water.

In the water the crocodile seems to enjoy its whole strength with greater advantage, than on land. Notwithstanding its size and apparent clumsiness, it moves about in the water with considerable agility. Although the great length of its body prevents it from turning suddenly round, it swims forward with great velocity when about to seize its prey. On land its motions are more embarrassed and it is consequently there a less dangerous enemy than in the water.

On hot days great numbers of these animals lie basking on the banks of rivers, and as soon as they observe any one approaching they plunge into the water.

The young of the crocodile are produced from eggs—deposited in the sand and hatched by the heat of the sun. The female is said to be extremely cautious in depositing them unobserved. The general number of eggs is from eighty to a hundred. They are not larger than those of a goose and are covered with a tough white skin. She carefully fills up the hole before she leaves them. They are hatched in about thirty days. The young ones, on emerging into the air, immediately run into the water, where multitudes of them are devoured by fish and even by larger animals of their own species. The ichneumon and the vultures seem peculiarly appointed to destroy the eggs and so abridge the enormous fecundity of the crocodile.

The Deadly Race of Serpents.

It is in this class of animals that we find the most terrible of all creatures; more potent than the roused lion, the enraged elephant, the deadly shark, or the mailed alligator. In the whole range of animal existence, there is none that can compare with the venomous snakes for the deadly fatality of their enmity; the lightning stroke of their poisonous fangs is the unerring signal of a swift dissolution, preceded by torture the most horrible. The bite of the rattlesnake has been known to produce death in two minutes. Even where the consummation is not so fearfully rapid, its delay is but a brief prolongation of the intense suffering.

The terrible symptoms are thus described:—a sharp pain in the part,

which becomes swollen, shining, hot, red ; then livid, cold, and insensible. The pain and inflammation spread, and become more intense ; fierce shooting pains are felt in other parts, and a burning fire pervades the whole body. The eyes begin to water abundantly, then come swoonings, cold sweats, and sharp pains in the loins. The skin becomes deadly pale or deep yellow, while a black watery blood runs from the wound, which changes to a yellowish matter. Violent headache succeeds, and giddiness, faintness, and overwhelming terrors, burning thirst, gushing discharges of blood from the orifices of the body, convulsive hiccoughs, and death.

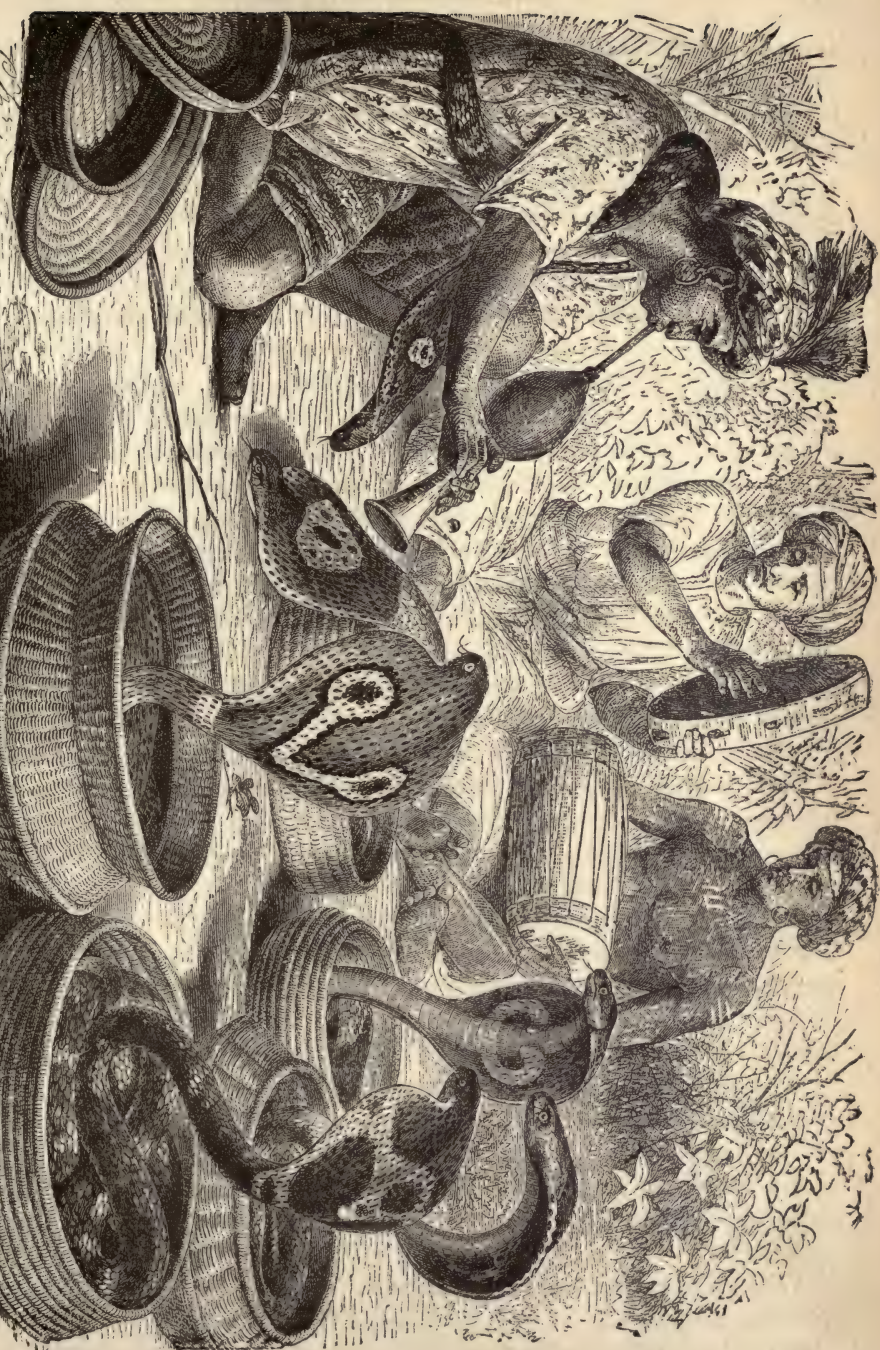
A Cobra's Poisonous Venom.

Buckland has described the awful effects of a dose of poison received from the cobra-di-capello in his own person. Fortunately it was a most minute dose, or we should not have received the account. A rat which had been struck by the serpent, Buckland skinned after its death. He scraped the interior of the skin with his finger-nail, forgetting that he had an hour before been cleaning his nails with his penknife. In so doing, he had slightly separated the nail from the quick, and into this little crack the poison had penetrated. Though the orifice was so small as to have been unnoticed, and though the venom was not received direct from the serpent, but had been diffused through the system of the rat, the life of the operator was almost sacrificed.

In India, where the species is common, its propensity to haunt houses frequently brings it under notice, and many accidents occur. It seems, however, on some occasions to be placably disposed, if not assaulted ; and some singular escapes are on record, of persons who have had presence of mind enough to let it alone. One is told of an officer who, having some repairs done to his bungalow, was lying on a mattress in the veranda, reading, nearly undressed. Perhaps his book was of a soporific tendency, for he dropped asleep, and awaked with a chilly sensation about his breast. Opening his eyes, he beheld, to his horror, a large cobra coiled up on his bosom, within his open shirt.

He saw, in a moment, that to disturb the creature would be highly perilous, almost certainly fatal, and that it was at present doing no harm, and apparently intending none. With great coolness therefore he lay perfectly still, gazing on the bronzed and glittering scales of the intruder. After a period which seemed to him an age, one of the workmen approached the veranda, and the snake at his footsteps left his warm berth, and was gliding off, when the servants at the cry of the artisan rushed out and destroyed it.

In October, 1852, Gurling, one of the keepers of the reptiles in the Lon-



ORIENTAL SNAKE-CHARMERS.

don Zoological Gardens, was bitten by a cobra-di-capello, and died. The circumstances of the case are worthy of record. Gurling left his home, in company with another keeper, on the evening before, and they spent the night at a leave-taking party of a friend going to Australia. On returning to their duties, they had a quartern of gin at a public-house, another afterwards, and again another at eight o'clock. The gin laden blood circulated through the brain; and reason, prudence, and the plainest sense of imminent hazard, were alike overpowered.

During the previous year, there had been an exhibition of Egyptian snake-charmers, but they had performed with cobras deprived of their poison-fangs. But the impression made on Gurling's mind coming uppermost when he entered the reptile-house, he determined to emulate the Egyptians with the serpents as they were. A newly-arrived Morocco poison-snake was first taken out of its cage, grasped by its middle, flourished aloft, and thrown like a lasso about his neck; when, happily for Gurling, it was not aroused so as to bite. An assistant-keeper, who appeared to enter the room at this crisis, entreated him, "for God's sake, to put back the snake!" but the infatuated man replied, "I am inspired," and laughed at the warning.

Deadly Poison Doing Swift Work.

Having replaced the Morocco venom-snake in its cage, Gurling cried, "Now for the cobra!" and, lifting up the glass front of the cage, removed the one as he had done the other. The cobra was somewhat torpid, from the cold of the preceding night, and the man placed it in his bosom. It then revived and glided downward round his wrist, its head emerging from beneath the back part of his waistcoat. The man grasped the cobra by the body, about a foot from the head, with one hand, drew it out, seized it lower down with the other hand, and was in the act of flourishing it aloft, as he had done the other snake, when, as he held it up in front of his face, the cobra, suddenly expanding its hood, struck him like lightning between the eyes, plunging its poison-fangs into the skin of one side of the bridge of the nose, and scratching the opposite side with the teeth of the lower jaw.

The man was staggered by the blow; the blood streamed down his face. He called for help, and his companion fled; but how long he was away he could not tell the coroner's inquest, "being," as he said, "in a maze."

When assistance arrived, Gurling was found seated in a chair, having restored the cobra to its cage, and closed down the front glass. He was still sensible and collected when placed in the cab that conveyed him to

the hospital, but expressed, in already palsied speech, his full conviction of speedy death.

On reaching the hospital he appeared almost, if not quite, unconscious, and unable to support his head. His face was livid, and his respiration very imperfect. He moved himself uneasily, pointed to his throat, and moaned. The power of utterance was the first lost; then that of vision; and, lastly, that of hearing. The pulse gradually sank, the extremities became cold and torpid, and he died without a convulsion or a struggle, about an hour after receiving the wound. The heart's action was renewed by mechanical inflation of the lungs, and artificial respiration, which at one time raised the pulse to seventy-five beats in a minute, was kept up half an hour after the natural breathing had ceased, and when the nervous system was dead. Galvanism was tried, but it had no effect.

Strange Incantations of Snake-Charmers.

The trade of serpent-charming is very ancient, and at an early date Africa was the chief theatre of those who practised it, and were called psylli. Pliny says serpents were frightened away by the mere smell of these psylli; and informs us that they came out into Italy to show their feats, and even brought scorpions with them. They are still to be found exercising their craft all over Asia.

Egypt is, probably, still their principal abode. A traveller states that he has met with many persons among the more intelligent of the Egyptians who condemn these modern psylli as imposters, but no one who has been able to account for the most common and interesting of their performances.

The most famous snake-charmers, he says, are durweeshees, or Mohammedan monks. The charmer professes to discover, without ocular perception (but perhaps he does so by a peculiar smell), whether there be any serpents in a house, and if there be to attract them to him, as the fowler, by the fascinations of his voice, allures the bird into the net. They have been known to do this in broad daylight, and when stripped naked.

The performer assumes an air of mystery, strikes the walls with a short palm-stick, whistles, makes a clucking noise with his tongue, and spits upon the ground; and generally says, "I adjure you, by God, if ye be above, or if ye be below, that ye come forth; I adjure you by the great name, if ye be obedient, come forth; if ye be disobedient, die! die! die!" The serpent is generally dislodged by his stick from a fissure in the wall, or drops from the ceiling of the room.

It is sometimes suspected that a servant carries the reptile. The most

expert charmers do not take with them venomous serpents until they have extracted their worst teeth. Many of them, like Pliny's psylli, carry scorpions in their caps, next to their shaven crowns; the sting, perhaps, having been blunted.

On the prophet's birthday the durweeshes perform some of their greatest wonders. Many live serpents were eaten during the traveller's visit. Whenever a devotee did this, he was, or affected to be, excited to do so by a kind of frenzy. He pressed very hard, with the end of his thumb, upon the reptile's back, as he grasped it, at a point about two inches from the head; and all that he ate of it was the head and the part between it and the point where his thumb pressed, of which he made three or four mouthfuls, and threw away the rest.

Death of the Famous "El-feel."

Serpents are not, however, always handled with impunity, even by these people. A few years ago a durweesh, who was called "El-feel," or the elephant, from his bulky and muscular form, and great strength, and who was the most famous serpent-eater of his time, having a desire to rear an enormous serpent which his boy had brought him, with others collected in the desert, put this one into a basket, and to weaken it kept it for several days without food. He then put his hand into the basket to take it out, for the purpose of extracting its teeth, but it immediately bit his thumb. He called out for help; but there were only women in the house, and they feared to come to him, so that many minutes elapsed before he could obtain assistance. He died in a few hours.

The serpents on which the charmers of Egypt and India exercise their art are chiefly cobras, which are best adapted for the display of their powers. The air of mystery thrown over their operations had led many to withhold from them all credit. But that snakes may be brought under the influence of music appears to be beyond dispute.

On this point a gentleman, then of high station in the East India Company's service, made the following statement: "One morning, as I sat at breakfast, I heard a loud noise and shouting amongst my palanquin-bearers. On inquiry, I found that they had seen a large hooded snake (cobra-di-capello), and were trying to kill it. I immediately went out, and saw the snake climbing up a very high green mound, whence it escaped into an old wall of an ancient fortification. The men were armed with their sticks, which they always carried in their hands, and had attempted in vain to kill the reptile, which had eluded their pursuit; in its hole it had coiled itself up secure, whilst we could see its bright eyes shining. I had often desired to ascertain the truth of the report, as to the effect of

music on snakes; I therefore inquired for a snake-catcher. I was told there was no person of the kind in the village; but after a little inquiry, I heard there was one in the village distant three miles. I accordingly sent for him, keeping strict watch over the snake, which never attempted to escape whilst we, its enemies, were in sight. About an hour elapsed, when my messenger returned, bringing a snake-catcher.

Snake Dancing to Music.

"This man wore no covering on his head, nor any on his person, excepting a small piece of cloth round his loins. He had in his hands two baskets, one containing tame snakes, one empty. These, and his musical pipe, were the only things he had with him. I made the snake-catcher leave his two baskets on the ground at some distance, while he ascended the mound with his pipe alone. He began to play; at the sound of music, the snake came gradually and slowly out of its hole. When it was entirely within reach, the snake-catcher seized it dexterously by the tail, and held it thus at arm's length; whilst the snake, enraged, darted its head in all directions, but in vain; thus suspended, it has not the power to round itself, so as to seize hold of its tormentor.

"It exhausted itself in vain exertions, when the snake-catcher descended the bank, dropped it into the empty basket, and closed the lid. He then began to play, and after a short time, raised the lid of the basket; the snake darted about wildly, and attempted to escape; the lid was shut down again quickly, the music always playing. This was repeated two or three times; and in a very short interval, the lid being raised, the snake sat on its tail, opened its hood, and danced as quietly as the tame snakes in the other basket, nor did it again attempt an escape. This, having witnessed with my own eyes, I can assert as a fact."

The Common Viper.

The venom of the viper, in our country at least, is not by any means so virulent as that of the serpent scourges in hotter regions. In the case of a bite, ammonia or hartshorn given internally, and fomentations applied to the part, to be gently rubbed afterwards with oil, are the remedies usually employed. The instances are very rare in which the bite proves fatal; and such instances generally occur in hot weather.

The viper varies constantly as to color; the ground color is mostly olive, sometimes deep brown, sometimes yellowish brown, and sometimes brick red. It is commonly asserted that the viper brings forth its young alive. This statement is both true and false. The young are produced, like those of all other serpents and lizards, by means of an egg; but the membrane which surrounds the young is broken at the moment of

birth, so that they can uncoil themselves at once. These, though but a few inches in length, crawl about, and are as fierce as the parent, throwing themselves, when molested, into an attitude of defense and hissing



THE VENOMOUS VIPER.

with anger. It is from this circumstance that the name *viper* is derived; being formed from two Latin words, *vivus*, "alive," and *pario*, "to bring

forth." In many places it is called "adder," from the Anglo-Saxon *nedre*, meaning *lower*, from its creeping position. This term is, of course, equally applicable to all serpents, and has, in fact, been so applied.

"Several intelligent folks," says White of Selborne, "assure me, that they have seen the viper open her mouth to admit her helpless young down her throat, on sudden surprises, just as the female opossum does her brood into the pouch, upon the like emergencies; yet the London viper-catchers insist on it that no such thing ever happens." We are disposed to think that they are right; at all events, there seems to be no fact adduced by any naturalist to sustain the contrary statement.

Swallowing Too Much.

Mice, lizards, and nestling birds are the food of this species. "I have in my possession," says Bell, "a specimen of a small viper in a dying state, in the act of attempting to swallow a mouse, which was too large for it, the skin of the neck being so distended as to have burst in several places." In another instance, a viper was found in the neighborhood of Lausanne which had seized a common lizard of full size, and swallowed it. The viper was a young one, and the lizard nearly as long as itself. It also appeared to have been very strong, and to have retained its vitality long after it descended into the stomach of its devourer. The consequence was, that it scraped with its little nails, until it made a hole through the side of the viper, and the fore leg was completely protruded. The specimen is preserved in the museum at Lausanne.

The æsping, called in England the aspic, is produced in Sweden. It is a small reptile, seldom exceeding six inches long, but more virulent, it is said, than the common viper, of which some naturalists regard it, and perhaps correctly, as a mere variety. Acrell states that Linnæus saw a woman perish in consequence of the bite of one, notwithstanding every assistance. The effects of the bite are followed by intense anguish and vomiting, the tongue swells and stiffens, the limb becomes inflamed, coldness supervenes, and occasionally death ensues.

The viper, or *apheh*, is referred to in Scripture, as an emblem of malignity and mischief. This is not, however, our common species, but one much more dangerous. It may be the one considered by Latreille the aspic of the ancients, or a larger species, which is extremely venomous, and found in the country bordering the Euphrates.

The Terrible Boa-Constrictor.

There are four species of "boa," all of which have been described as the boa-constrictor; and it is always difficult to identify any particular species of serpent referred to by travellers, on account of the loose manner in

which the name is generally employed. The boa-constrictor is remarkable for the beauty of its markings. A broad chain, consisting alternately of large blackish and somewhat hexagonal marks, and of pale oval dashes, extends along the back. These gigantic snakes frequent the marshes, and luxuriant margins of the rivers, and fresh-water lakes of intertropical



RAVENOUS BOA-CONSTRICTOR SWALLOWING A FOWL.

America, and reign the terror of man and beast. They can climb, swim, and dart along the ground; and hence there is no safety for the deer in its swiftness or the monkey among the branches, or the large fish in the waters.

To these varied powers, combined with a nature daring, ferocious, and bloodthirsty, the ancient Mexicans rendered religious veneration. Their

supreme divinity was represented with a snake in his hand, or coiled round him and his altar.

On a blue throne, with four huge silver snakes,
As if the keepers of the sanctuary,
Circled with stretching neck and fangs displayed,
Mexitli vatæ ; another grown snake
Belted with scales of gold his monster bulk.

To adopt the words of Lacépède, in reference to the boa, " This great power, this indomitable force, its gigantic length, the lustre of its scales, the beauty of its colors, have inspired a sort of admiration, mingled with affright, in the minds of most people in a savage condition ; and, as all that produces terror and admiration, every creature that appears to be endowed with a great superiority over other beings, hardly fails to create in minds little enlightened the idea of a supernatural agent, it was not without religious fear that the ancient inhabitants of Mexico regarded this serpent. Whether they supposed that an enormous mass, executing movements so rapid, could not be stirred but by a divine inspiration, or that they only regarded the animal as a minister of the omnipotence of the God of heaven, it became the object of their worship.

Making a Divinity of the Boa-Constrictor.

" They gave it the title of 'emperor', in order to designate the preeminence of its endowments ; and, having adopted it as the object of their adoration, they devoted to it their particular attention. None of its movements, speaking in a general sense, escaped them ; none of its actions were to them matters of indifference. As its protracted hiss caught their ear, they listened with religious trembling, for they deemed that these sounds, these signs of the various passions, or feelings of a being, which they regarded as supernatural, must be connected with their destiny.

" It has happened, that these hissings have been much stronger, and more frequent on the approach of violent tempests, pestilential diseases, cruel wars, or other public calamities. Indeed, it is frequently the case that epidemic maladies are often preceded by a violent heat, an extreme dryness, a peculiar state of the atmosphere, a highly electrical condition of the air, by which the snakes would be greatly excited, and led to utter hissings louder than usual ; however, this may be, the hissings of the boa, the 'divine boa', were regarded as forewarnings of impending evils, and listened to with the utmost consternation."

A fearful picture of the blind and impious adoration paid to the ferocious boa, often tamed by the priests, for the purpose of overawing the multitude, is finely drawn by Southey, in his poem of " Madoc :"—

Forth from the dark recesses of the cave
 The serpent came ; the Hoamen at the sight
 Shouted ; and they who held the priest, appall'd,
 Relaxed their hold. On came the mighty snake,
 And twin'd in many a wreath round Neolin,
 Darting aright, aleft, his sinuous neck,
 With searching eye, and lifted jaw, and tongue
 Quivering, and hiss as of a heavy shower
 Upon the summer woods. The Britons stood
 Astounded at the powerful reptile's bulk,
 And that strange sight. His girth was as of man,
 But easily could he have overtopp'd
 Goliath's helmed head, or that huge king
 Of Basan, hugest of the Anakim :
 What then, was human strength, if once involved
 Within those dreadful coils ! The multitude
 Fell prone and worshipp'd.

Stedman, in his expedition to Surinam, had an adventure with one of these boas, which shows their vast power and activity. On leaving his boat, he had scarcely proceeded above twenty yards through mud and water, when he discovered a huge snake rolled up under the fallen leaves and rubbish of the trees ; and so well was the animal covered, that it was several minutes before he distinctly perceived the head of the monster, which was distant from him only about sixteen feet. It was rapidly vibrating its forked tongue, and its eyes, from their uncommon brightness, glittered like sparks of fire. He raised his gun, and fired ; but missing the head, the ball went through the body.

In a moment the animal struck round, lashing the ground with such force as to cut away all the underwood as if with a scythe, while the mud and dirt flew in all directions. Following up the attack, Stedman, who at first retreated, now ventured on, and found the snake at a short distance from the former station, quietly lying among fallen leaves, rotten boughs, and moss, which concealed all but the head. He fired again ; the animal was again wounded, and violently flounced about, throwing a shower of mud and dirt around. At the third fire, the animal was shot through the head, and soon expired. The length of this snake, which the negroes declared to be young, was upwards of twenty-two feet ; and its thickness that of a boy about twelve years old.

Swallowing a Bed.

One of the boas of the London Zoological Gardens once swallowed his bed, to-wit, a large railway blanket wrapper, instead of two rabbits, which had been left him for his supper ; when the problem propounded was the life or death of the reptile. Thirty-six days after, however, he evaded

the catastrophe by beginning to disgorge the blanket. A watchman, going his nightly rounds, caught him in the act; he presently called another watchman to his side, and entering the cage they assisted the boa, both of them giving a slow, careful pull at one end; and thus he completed his task.

The wrapper was about five feet wide and six feet long; it proved to be entire, with the exception of a few small holes and rents, and an appearance of rottenness in two or three places. The colors were nearly all discharged, so that the fabric was of a dingy, slaty gray.

After disgorging the blanket, the boa ate nothing during a whole week, but resumed his usual habits, by drinking a large quantity of water. This is said not to have been the first time such a feat has been performed in the Gardens; and a serpent is even stated to have remained the victor of his blanket.

The boas are the largest of serpents, and though without venom, their enormous muscular power enables them to crush between their folds large animals, which they first lubricate with saliva and then swallow whole by their enormously dilatable jaws and gullet. They never attack but from necessity, always engage with open courage and conquer only by superior strength. Three species are found in Asia; the rest are confined to the warmer parts of America. The great boa, the largest of all the serpent tribe, is frequently from thirty to forty feet in length and of proportionable thickness. Their rapacity is often their own punishment; for whenever they have gorged themselves by trying to swallow their prey entire, they become torpid and may be approached and destroyed with safety. They at that time seek for some retreat, where they may lurk for several days and digest their meal in safety. The least effort then will destroy them; they scarcely can make any resistance; and equally unqualified for flight or opposition, they are easily assailed.

Beautiful Tree-Snakes.

There are many serpents of very slender form, which, while living more or less on the land, frequently ascend trees, especially in pursuit of their prey. They are generally nimble, harmless, and beautiful species.

The whole of the serpents composing these genera live in woods, entwining themselves among the branches of trees, and gliding with great rapidity and elegance from one to another. These habits, combined with the graceful slenderness of their form, the beautiful metallic reflection from the surface in some species, and the bright and changeable hues in others, place them among the most interesting of the serpent tribe. Their food consists of large insects, young birds, and so forth, which the

extraordinary size of the head, and width of the gape, and the great dilatability of the neck and body, enable them to swallow, notwithstanding



TREE-SNAKE DEVOURING ITS PREY.

the small size of these parts in a state of rest, undisturbed by hunger.

When the skin is distended either by food or during inspiration, the

scales are separated from each other, and the skin, which is of a different color, becomes visible in the interstices, producing a curious reticulated appearance. Notwithstanding the poisonous mark was affixed by Linnaeus to the only species known to him, it is well ascertained that they are all of them perfectly harmless; and it is asserted of some species that the children are in the habit of taming and playing with them, twining them round their necks and arms, and that the snakes appear pleased at being thus caressed.

The variety of whip-snakes are distinguished for their thin, slender body, which enables them to wind themselves around the branches of trees and lay in wait for their prey. They are only at home on trees. On the ground they are slow and clumsy in their motion. They are nocturnal animals and therefore very dangerous to all small vertebrates which happen to visit a tree, which they have chosen as their habitation. They feed on birds, lizards and frogs, and are said to be very voracious. The whip-snake of Ceylon has a very pointed mouth, for what purpose is not explained yet to the satisfaction of scientists.

Poisonous Tenants of Forest and Plain.

Many of the snakes of South America are highly venomous. One of these is called, from its prowess and power, the bush-master. Frightful accidents occur in the forests of Guiana by this terrible species. Sullivan gives us the following: his host, a few days before, had sent a negro to open some sluices on his estate; but, as he did not return, the master, thinking he had run away, sent another negro to look after him; this negro went to the place directed, and found the man quite dead, and swollen up to a hideous size. He was bitten in two places, and death must have been instantaneous, as he was not more than three feet from the sluice. They supposed that it must have been a bush-master that had killed him.

The couni-couchi, or bush-master, is the most dreaded of all the South American snakes, and, as his name implies, he roams absolute master of the forest. They will not fly from man, like all other snakes, but will even pursue and attack him. They are fat, clumsy-looking snakes, about four feet long, and nearly as thick as a man's arm; their mouth is unnaturally large, and their fangs are from one to three inches in length. They strike with immense force; and a gentleman who had examined a man after having been struck in the thigh and died, told the narrator that the wound was as if two four-inch nails had been driven into the flesh.

As the poison oozes out from the extremity of the fang, any hope of being cured after a bite is small, as it is evident that no external applica-

tion could have any immediate effect on a poison deposited an inch and a half or two inches below the surface; the instantaneousness of the death depends upon whether any large artery is wounded or not.

Serpents of Astonishing Beauty.

Many serpents are remarkable for their great beauty of coloring, or for the pattern of their markings; but on account of the poisonous property so many possess, the whole order is popularly regarded with horror and apprehension, and the most foolish tales are current respecting various species of them. Thus many people suppose that there are snakes which rob cows of their milk; and the skeleton of a child being found in the same hollow with a number of harmless snakes it was concluded, as a matter of course, that the serpents must have both killed the child and stripped off its flesh, a thing which no snake could possibly do. People are prone to exaggerate, and commonly evince a fondness for the marvellous, which induce those of hot countries more especially to declare every snake met with to be the most venomous one in their country; and thus travellers often come away with exceedingly erroneous impressions on the subject.

The Indian region surpasses every other part of the globe in the number and variety of its serpents; and almost every investigation of a limited but previously unexplored district, is tolerably sure to add largely to our previous knowledge of them. What, however, the late Sir Emerson Tennent asserts of those inhabiting Ceylon is equally applicable to other parts of the Indian region. During my residence in Ceylon, he remarks, I never heard of the death of a European which was caused by the bite of a snake; and in the returns of coroner's inquests made officially to my department, such accidents to the natives appear chiefly to have happened at night, when the reptiles, having been surprised or trodden on, inflicted the wound in self-defence. For these reasons the Cingalese, when obliged to leave their houses in the dark, carry a stick with a loose ring, the noise of which, as they strike it on the ground, is sufficient to warn the snakes to leave their path.

Foolish Popular Superstitions.

In some parts of the vast Indian region the natives regard the harmless chameleon as venomous; in other parts various geckos or other lizards. In Bengal there is a current notion regarding a terrifically poisonous lizard, which is termed the bis-cobra, but which has no existence except in the imagination of the natives, who bring the young of the monitors and occasionally other well-known lizards as specimens of the object of their dread. Again, the little burrowing snakes which, superficially, have

much the appearance of earth-worms, are there popularly regarded as highly poisonous, though not only are they harmless, but physically incapable of wounding the human skin. Strangers who are little versed in zoology are commonly led astray by such errors on the part of natives of those countries, and, unfortunately, there is a number of stock vernacular names which are applied to very different species in different localities.

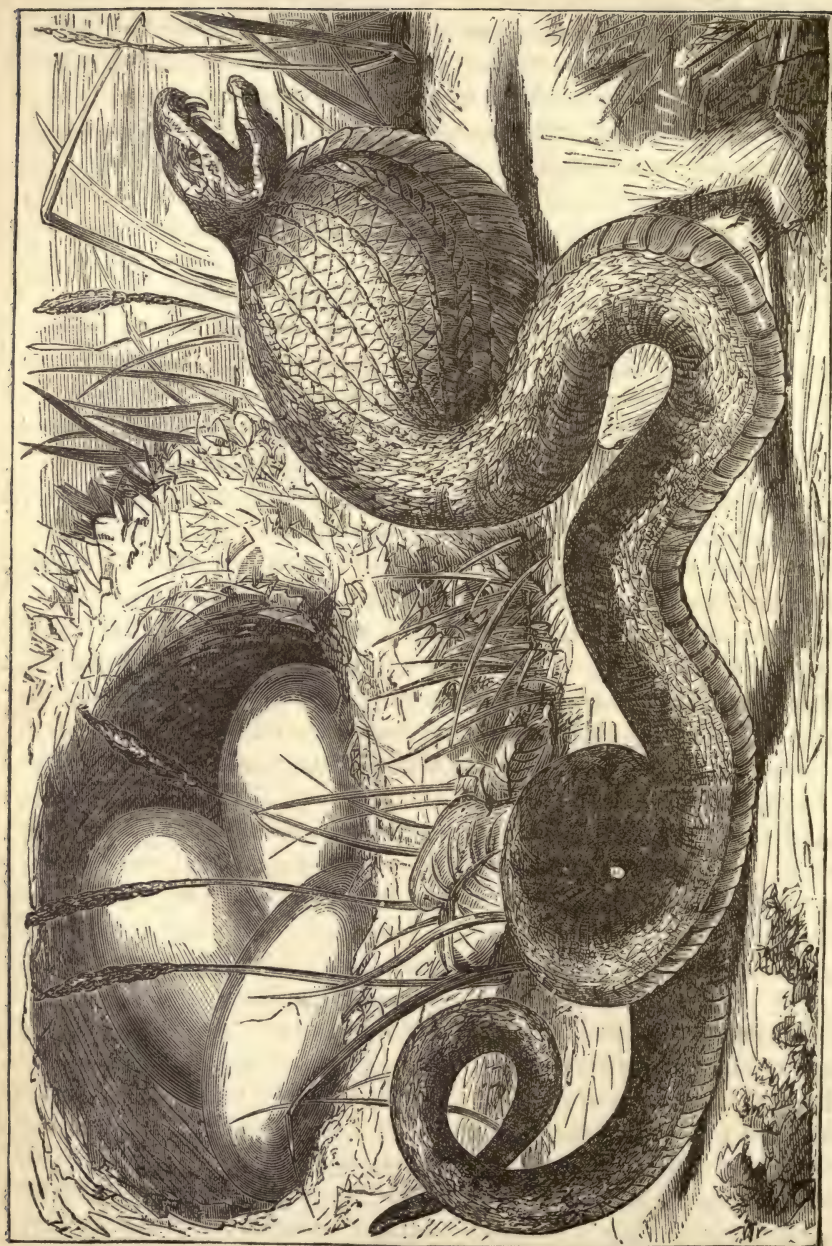
Thus Europeans in India are familiar with the appellation "carpet snake," as denoting a very deadly reptile, but nobody can there point out what the carpet snake really is; and the one most generally supposed to bear that name is a small innocuous snake, which is common about human dwellings. In the Australian colony of Victoria, however, the appellation of carpet snake is bestowed upon a terribly venomous species, while in the neighboring colony of New South Wales, a harmless and even useful creature is habitually known as the carpet snake.

With regard to the poison of venomous snakes, attention has lately been directed to the virtue of ammonia, as already stated. This should be administered internally, mixed with alcoholic spirit and water, in repeated doses; and it should also be injected into a vein—about one drachm of the *liquor ammoniæ* of the shops being mixed with two or three times that quantity of water. The patient should be kept moving as much as possible, and the effects of a galvanic battery should also be tried in cases where animation is nearly or quite suspended. By these means it is asserted that quite recently some very remarkable cures have been effected in Australia.

The serpents have many enemies among mammalia, such as the well known mongoose, also swine, and various ruminating quadrupeds as deer and goats. In the bird class, the famous serpent-eater, or secretary-bird of South Africa, is one of their chief destroyers; and there are various other snake-devouring birds of prey, besides the great African ground hornbill—even the peafowl, sundry storks, and other waders, seldom fail to attack them when opportunity offers. Comparatively large birds of the kingfisher family prey chiefly upon snakes and lizards in Australia; and of reptiles, besides those snakes which prey upon others, the monitor lizards frequently seize and devour them.

Monstrous Egg Eater.

The enormous swallowing power of snakes is vividly illustrated in a very small snake, the opposite extreme from the huge creatures we have been considering, the so-called egg-eater of South Africa, a little fellow not more than a foot long, of which we give nearly a life-size illustra-



THE RAVENOUS EGG-EATER.

tion. With jaws not more than an inch apart when wide open, it will swallow an ordinary hen's egg without breaking it. If such be the capacity of a snake not more than twelve inches long, what must be the great gulp of one thirty feet long and of proportionate thickness?

It may seem an incredible statement to many persons that any reptile possesses beauty, yet among these crawling creatures, disgusting in many instances, there are forms and colors unrivalled, or at least unexcelled, in any other part of creation. There is, for instance, what is called the red-throated lizard.

This beautiful reptile is a native of the West India Islands. Its color is green, more or less tinged with blue. There is no dorsal crest; the tail is large, strong, and slightly depressed at its base—its remainder being slender, and slightly compressed; a minute dentated ridge runs along its upper surface. The scales on the back and sides are very small, somewhat oval and granular, and of equal size. Those on the under parts are smooth, and overlay each other. When irritated, the throat swells, and becomes as red as a cherry.

"Some years since," says Mr. Bell, "I had two living specimens of the beautiful little green creature of the West Indies. I was in the habit of feeding them with flies, and other insects; and having one day placed in the cage with them a very large garden spider one of the lizards darted at it, but only seized it by the leg. The spider instantly ran round the creature's mouth, weaving a very thick web round both the jaws, and then gave it a severe bite on the lip, just as this spider usually does with any large insect which it has taken. The lizard was greatly distressed, and I removed the spider, and rubbed off the web, the confinement of which appeared to give it great annoyance; but in a few days it died, though previously in as perfect health as its companion, which lived for a long time afterwards."

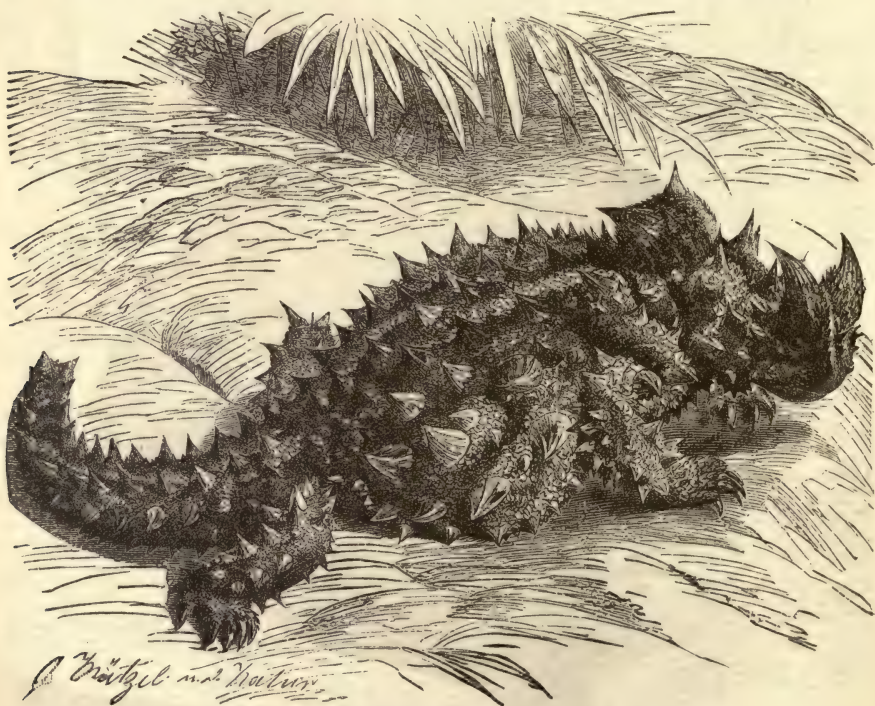
In contrast with this is an ugly creature which deserves notice.

The Cristatus.

In that group of islands called the Galapagos, near the Equator, in the Pacific Ocean, this lizard abounds, and the species is found there in great numbers. It selects a rocky shore for its place of resort, and appears never to be found far inland. Specimens four feet in length have been discovered; the usual length, however, is about three feet. In rare instances its weight reaches twenty pounds. The appearance of the cristatus is very repulsive. It is a hideous-looking creature, very sluggish in its movements. Its color is a dirty black, and it lacks those rich tints which distinguish many of the lizard tribes. Some travelers report having seen

the cristatus one or two hundred yards from shore, swimming about, and Captain Colinett, in his "Voyages," says he has observed them going out to sea in shoals. Considering the authority, full reliance can be placed upon this statement.

This animal is quite at home in the water. It easily propels itself by the use of its flattened tail, holding its legs close to the sides of its body. With rapidity and gracefulness it thus moves about in the shallow water. This lizard has been known to remain beneath the surface an hour, yet to



THE MOLOCH.

be quite active upon being brought up and placed on shore. It has strong limbs and claws, which are well adapted for clambering over the rough lava crusts found everywhere among the islands it inhabits. It is nothing unusual to see a group of half a dozen of these hideous creatures stretched upon the rocks, dozing in the sun.

The moloch is an Australian iguanian reptile and is the most ferocious looking of the lizard tribe, though harmless; it is as ugly as any of the representations of the fabled basilisks and dragons. They live in sandy districts and sometimes dig themselves into the sand, sleeping at night and leaving their resting-place during the day, in search of prey. They

principally feed on ants, but are said to be also herbivorous. Like other lizards, they deposit their eggs in the sand.

A Hideous Toad.

It is proper to caution the reader against believing all that has been written about the longevity of toads. Neither must implicit faith be given to the discovery of the living animal in the centre of stones. "That toads, frogs, and newts, occasionally issue from stones broken in a quarry



PIPA TOAD HATCHING EGGS ON ITS BACK.

or are discovered in sinking wells, and even taken from coal-strata at the bottom of a mine," is true enough; but, as Buckland observes, "the evidence is never perfect to show that these amphibians were entirely enclosed in a solid rock; no examination is made until the creature is discovered by the breaking of the mass in which it was contained, and then it is too late to ascertain whether there was any hole or crevice by which it might have entered."

These considerations led Buckland to undertake certain experiments to test the fact. He caused blocks of coarse oolitic limestone and sandstone to be prepared with cells of various sizes, in which he enclosed toads of different ages. The small toads enclosed in the sandstone were found to die at the end of thirteen months; the same fate befell the larger ones during the second year; they were watched through the glass covers of their cells, and were never seen in a state of torpor, but at each successive examination they had become more meagre, until at last they were found dead. This was probably too severe a test for the poor creatures, the glass cover implying a degree of hardness and dryness not natural to half amphibious toads.


This animal, the common toad, is badly provided with means of progression, is timid and solitary in habits, and shuns the sight of man, as if it comprehended the repugnance with which it is regarded. It is, nevertheless, susceptible of education, and has been tamed. Pennant, the zoologist, relates some curious details respecting a poor toad which took refuge under the staircase of a house. It was accustomed to come every evening into a dining-room near the place of its retreat. When it saw the light it allowed itself to be placed on a table, where the host furnished it with worms, wood-lice, and various insects. As no attempt was made to injure it, there were no signs of irritation when it was touched, and it soon became, from its gentleness, the object of general curiosity; even ladies came to see this strange animal. The poor batrachian lived thus for thirty-six years; and it would probably have lived much longer had not a tame crow, living in the house, attacked it, and put out one of its eyes. From that time it languished and died.

Nearly allied to the common toads the surinam toad holds its place. Its physiognomy is at once disagreeable and peculiarly odd; the head is flat and triangular, a very short neck separates it from the trunk, which is itself depressed and flattened; its eyes are extremely small, of an olive, more or less bright color, dashed with small reddish spots; it has no tongue. There is only one species of pipa, viz.: the American pipa, which inhabits Guiana and several provinces of Brazil. The most remarkable feature in this batrachian is its manner of reproduction. It is oviparous; and when the female has laid her eggs, the male takes them, and piles them on her back. The female, bearing the fertilized ova, reaches the marshes, and there immerses herself; but the skin which supports her future progeny soon becomes inflamed, causing an irritation of the integument, which continues till all are absorbed into the skin. The young are rapidly developed in these dorsal cells, and soon born.

CHAPTER XIX.

MARVELS OF INSECT LIFE.

Intelligence Among Insects—All Sorts of Insect Mechanics—Pillaging Pirates—The Goliath Beetle—Monstrosities and Freaks—"Little Devils"—Gorgeous Coloring of Shells and Wings—Jewelry made of Insects—Wingless Butterflies—Extraordinary Changes Through Which Insects Pass—Metamorphosis of the Dragon-Fly—Perfection of Organization—Wonderful Handiwork of Nature—Gnats More than a Match for Men—The African Fly—A Dreaded Pest—Magnified Proboscis of a Common Fly—Amazing Rapidity of Movement—Insect Gymnasts and their Strength—Ingenious Mechanisms—Transformation of the Common Gnat—Insect Saws, Rakes, and Chisels Surpassing Man's Finest Instruments—Curious Method of Talking—Eyes Like Telescopes—Military Drill—The Remarkable Achievements of the Spider—An Insect Better than it Appears—Slave-Holding Ants—A Colony Saved by an Old Slave—Insects that Keep a Dairy—Ants and their Milch Cows—Warrior Termites—Builders and Destroyers of Towns.

O a marvelous delicacy of organization insects join a still more marvelous intelligence. The perfection of their tools would lead us to suppose them capable of executing works of boundless variety; it is these that Rennie has designated as the architecture of insects. In fact, these minute creatures often rear constructions of an elegance and size which we should be far from expecting from them. Among insects there are evidently architects, masons, upholsterers, paper-makers, joiners, pasteboard-makers, and hydraulic-engineers. Others dislike work, and are veritable pirates, always engaged in war and pillage. We find also in this class extremes of size and strength. One gigantic beetle, such as for instance the Goliath, may exceed the size of the straight-beaked humming-birds, which he would pitilessly strangle in his claws if he caught them in his path; while another insect may be so small, so calculated to escape notice, that we only discover it by the aid of a magnifying-glass.

The insect class shows in every part a harmonious organization, which at the first glance distinguishes it from all others. Nevertheless, it is perhaps the section of the animal kingdom in which we observe the greatest diversity of form; some insects indeed display at times such anomalies that we can only make them out by their fundamental characteristics. There are even frequently extreme differences between the male and the female. Others possess such a singular exterior that they exactly resem-

ble leaves of trees, having the same veins and coloring; when they are at rest we might take them for leaves, and even the greedy bird is deceived by them. It is the wings that are transformed into green membranes, which give the animal the appearance of an animated leaf.

Some insects again are remarkable from the strangeness of their aspect, the breasts of which are studded with points, plates, or most fantastic knobs, which transform them into so many monstrosities. On looking at some of them one might take them for an insect masquerade, a veritable sport of nature, a collection of freaks. So much was the old entomologist Geoffroy struck with their form, that he gave them the name of "little devils." One cannot really conceive what purpose so many fantastic appendages, so embarrassing to their figure and movements, can serve among these fragile tribes, for they are all of the smallest dimensions!

Hues that Rival Gold and Sapphire.

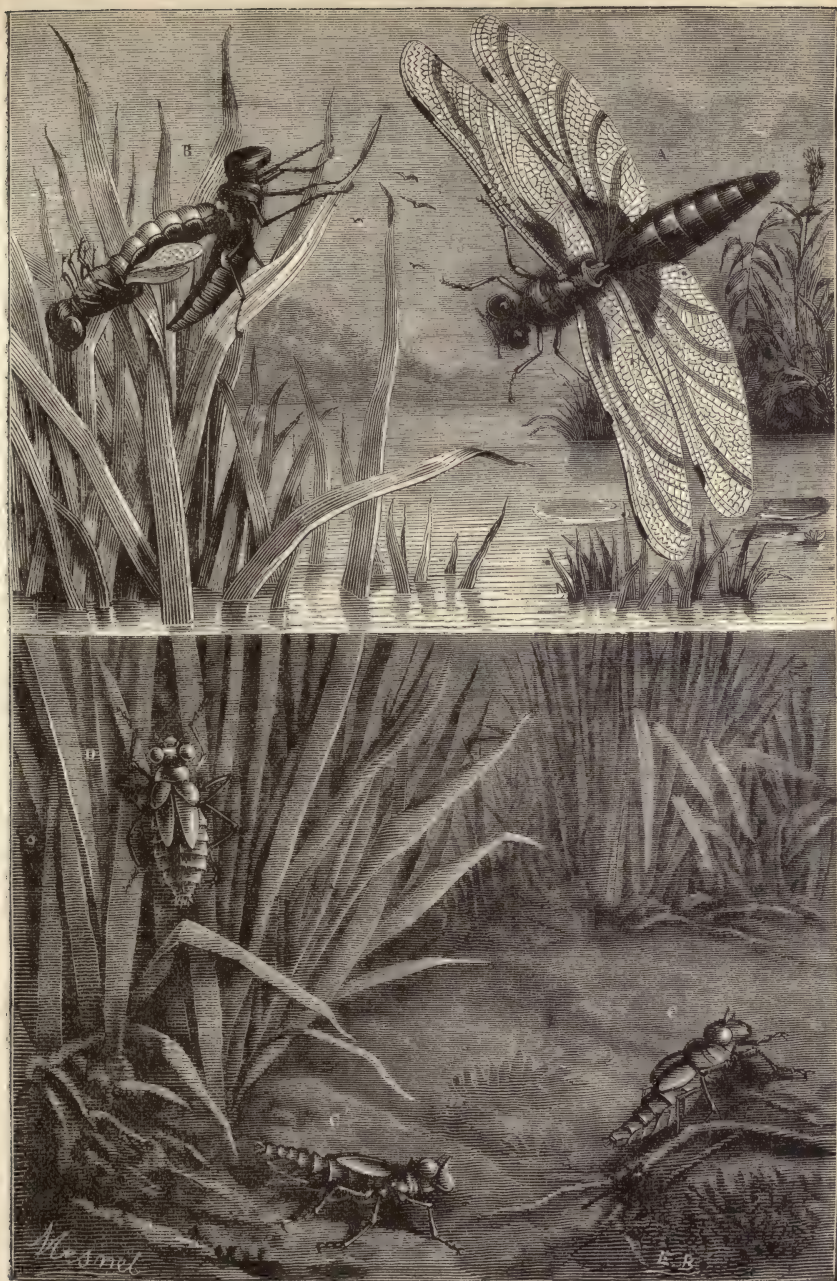
If anything in insects surpasses the diversity of forms, it is the prodigious variety of coloring. Their mantles gleam with the richest hues in nature. Their sheen can only be compared to that of jewels and metals. The purest gold and silver, the sapphire and the emerald, gleam on their wings and corsages; their tints mingle and encounter, or imperceptibly shade into each other. Some groups are remarkable for the richness of their garments. One variety owes its French name of "millionaires" to its metallic lustre; others gleam like precious stones, and are used instead of them in India and China, where they are made into trinkets for women, such as pins and ear-drops.

As the great Lannæus said, Nature takes no leaps, and among insects she proceeds as elsewhere, by insensible transitions. We are accustomed to recognize a butterfly only by its ample wings; nevertheless naturalists have discovered many species of this order which are wingless. But although we see some individuals of this group deprived of these organs, others exhibit the vestiges of them to show the gradation.

Singular Transformations.

Born in one shape the insect dies in another, and the metamorphoses which it undergoes are the most important act of its life, and the most extraordinary phenomenon in physiology. Organism, functions, all things change: the ugly caterpillar is transformed into a butterfly gleaming with azure and gold, and if this butterfly were restricted to the fresh leaves of which it devoured such quantities in its youth, it would die of inanition; it requires a more delicate nourishment now that it has become adorned with its brilliant wings, and only lives on the nectar of flowers.

The libellula, or dragon-fly, when it appears in its last dress, assumes



LIFE AND METAMORPHOSIS OF THE DRAGON-FLY. *a.*—THE PERFECT INSECT. *b.*—THE INSECT CASTING OFF ITS WORN-OUT NYMPH'S SKIN. *c d.*—LARVÆ AND NYMPHS.

different habits. It has passed all its life beneath the water in the condition of an ignoble larva, soiled with mud and filth; but now that the time has come, it aspires to soar into the air. Having mounted on some plant or other, it attaches its aquatic garment to it, and equips itself with brilliant wings of gauze which bear it away. The metamorphosis is so radical and its new wants so imperious, that if we attempt to retain the insect a single minute longer in its ancient element it will perish on the spot. It has lived till now in shade and tainted water; henceforth it can only breathe the pure air and in a glowing light.

The grown insect differs so widely from the young, that one cannot in the least recognize the one in the other. The scarabæus, or sacred beetle, with its emerald sheath, which was worshipped in ancient Egypt, does not in the least resemble the hideous subterranean worm which produces it; a singular metamorphosis, in which, according to Goury, the nations on the banks of the Nile only beheld the symbol of the transmigration of souls.

Marvels of Insect Organization.

The torch of anatomy has shed a flood of light upon the organization of the inferior animals, and the microscope, by allowing us to pry into the most inaccessible nooks of it, has unfolded before our eyes a horizon as vast as it was unexpected. But it must be admitted, that if the investigation of infinitely small beings has acquired such an advanced degree of certainty, it owes it to men who have often devoted all their lives to the object. Lyonet, of Germany, passed nearly all his life in studying a caterpillar which gnaws the wood of the willow, and produced on this insect only one of the most splendid monuments of human patience.

Goedart, a Dutch painter, spent twenty of his best years in watching the metamorphoses of insects—a most interesting spectacle for him who looks at it with the eye of religion. Hence, in the midst of our most brilliant parties (into which affliction will yet make its way despite both pomp and gold), he felt tempted to exclaim, “Ah! let me rather see a butterfly born. In his puniest creatures God reveals his power and majesty; you, in your splendid fêtes, often display only your weakness and misery!” Anatomically and physiologically speaking, the human mechanism is very rude and coarse, compared to the exquisite delicacy revealed in the organism of certain animals.

In her slightest sketches nature knows how to unite power to an exquisite fineness of mechanism; the first glance at insects proves this, and thus so soon as their interesting history is displayed before us, we feel no longer tempted to treat them with the disdain that poets have shown. A simple

butterfly, a single fly humbles the pride of man, and despite of him levels his forests, devours his crops, and reduces him to despair. An insect of this kind petrifies the countryman with terror, while its sting is death to him!

Man Conquered by Gnats.

Simple little two-winged flies, gnats and mosquitoes, the puny look of which would never lead one to dread aggression from such a quarter, are nevertheless enemies of the most inconvenient kind to our species. In some countries, where they swarm by myriads on all sides, man is subjected to their empire, and only avoids their attacks by adapting his abode and manner of living to the emergency. At the time when the mosquitoes are most prevalent in Senegal, the negroes, notwithstanding the constraint of such a kind of life, remain constantly enveloped in the midst of thick smoke. For this purpose they set up regular roosts formed of branches, and suspended above masses of wood which burn perpetually beneath them. Squatted on these they receive their friends during the day, and at night, heated from below and smoked on all sides, they stretch themselves on them in order to sleep.

A simple fly in Africa does still more; it disputes the land foot by foot; there is a struggle between it and man as to which shall have possession. Where it lives it prevents him from carrying on agriculture, and limits his explorations; he can only become master of the soil when he has exterminated it. This fly, generally called "tsetse" by the natives, is shaped like our common species, and seems to all appearance equally inoffensive, but its mouth secretes a venom the activity of which by far surpasses that of the most redoubtable serpents. It only requires a few of its stings to overwhelm the strongest ox; and yet if we attempted to ascertain the weight of this deadly agent by means of the most delicate balance, it is so small that we should find the calculation impossible.

The domestic fly, inoffensive in our dwellings, torments without ceasing those who travel in hot countries. There it is dreaded more than the hyæna and jackal, and men can only guard against it by having a crowd of slaves about them. In some of the villages of Upper Egypt travellers have sometimes seen in their mother's arms children whose faces were infested by such compact legions of flies that they looked like crawling black masks. All were hard at work with their probosces, the delicate anatomy of which surpasses everything one can imagine.

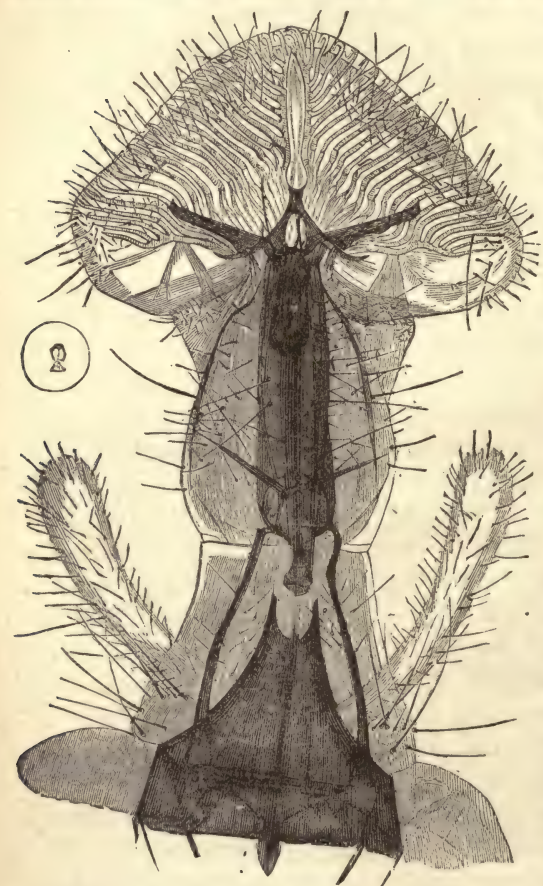
In the domain of the infinitely little the physiological phenomena astonish us no less than the extreme slightness of the motive organs! A single comparison will demonstrate this. When we commune an

elevating movement to our arms, and suddenly bring them back to the body, a second of time will scarcely suffice for the act; but, according to the experiments of Herschel, some insects vibrate their wings several hundred times in this short period! Latour affirms that a gnat vibrates its wings 500 times in a second.

Nicholson goes still further; he asserts that the vibrations of the wing of the common fly are as many as 600 in a second, since it passes through

space at the rate of six feet in this time. But this observer adds, that for rapid flight we must multiply this number by six, which means that in a second, or the time we require to execute a single movement of one of our members, the fly with its wing can perform 3600. The mind is stupefied at such calculations, and yet they are of unimpeachable accuracy!

After this we are no longer astonished at the activity shown by some butterflies, such as the sphinx, when they rifle the flowers of our gardens. They flit from one to the other with the speed of an arrow, and, like the straight-beaked humming-bird, they hang motionless before the corolla, plunging their long tongues to the bottom in



MAGNIFIED PROBOSCIS OF THE COMMON FLY.

order to sip the nectar, whilst their wings are agitated by movements which the eye cannot follow!

The delicacy of these aërial oars is not less remarkable than their movements. However gently we take hold of the wing of a butterfly, our fingers never leave it without having some particles adhering, which seem

only a fine dust, the source of the magnificent coloring of the insect. But when this dust is submitted to microscopic examination, the observer is surprised to see that each of these grains represents a little flattened plate, lengthened out and of a fine complicated structure, which reflects the most magical colors.

Notwithstanding their minuteness and the delicacy of their anatomy, other insects exhibit a comparative strength which astonishes us. Although it is almost puerile to speak of the flea, still we may take it for an instance, as it is unfortunately known everywhere. Fonvielle, in his interesting work on the "Invisible World," maintains that it can raise itself from the ground to a height equal to two hundred times its stature. At this rate, a man would make little effort in jumping over the Capitol at Washington, or the highest church spires; and a prison would be an impossibility unless the walls were built more than a quarter of a mile in height.



COMMON GNAT AND ITS METAMORPHOSES:
NYMPHS AND PERFECT INSECTS.

In the case of insects inhabiting the water, the most admirable precautions prevent the fluid from forcing its way into the air passages. Sometimes at the entrance of the respiratory organ there is a door, with five or

six leaves of the most ingenious mechanism, which the animal opens or shuts at will. It only opens them when it comes to the surface of a pool to breathe; when it plunges into the depths the leaves of this little air-door are closely shut, and the pneumatic channels are efficaciously defended against the invasion of the liquid, which would disturb the organization. This is seen in the larva of the common gnat, which swarms in our stagnant waters.

In the larger animals the respiratory function is performed by the aid of a distinct, restricted apparatus, confined to one region of the body. In the insects it has a much larger field of action. The air diffuses itself everywhere, and after having overflowed the internal organs by means of particular vessels, which are easily distinguished by their pearly tint, it reaches the extreme terminations of the feet and antennæ. For this purpose these are provided with a most remarkable structure. They are composed of fine layers, rolled in, like the metallic thread in an elastic brace. This arrangement serves to keep their walls separated, and to facilitate the free circulation of air through their imperceptible canals.

Machinery for Breathing.

Every person must have seen, and with some disgust too, a white larva with a long tail, which lives in the filthy stagnant waters of our courts and roads, and which is vulgarly called the maggot. The extraordinary tail to which the animal owes its name is an organ of respiration. It contains two vessels which disseminate the air through all the body of this fly-larva, for such it is. These two aerial canals are enveloped by tubes of a different calibre, which fit one into another and move exactly like the tubes of a telescope.

This worm, not having any swimming organ, possesses in this ingenious arrangement a means of constantly opening the orifice of its breathing apparatus at the surface of the water, whatever may be its level. If the liquid sink in the puddle which it inhabits, all the tubes enter one another like those of a telescope and the aerial tubes wind inside them. If, on the contrary, a violent shower should make the water rise above its bounds, they are all projected outwards, being drawn out as far as possible so that their orifices still reach the surface.

The final intention of nature is so manifest in this circumstance, that if we, in imitation of Réaumur, plunge one of these larvæ into a glass containing only a little water, and the quantity of this be gradually augmented, the insect's tail lengthens in proportion and even acquires an extraordinary size, in order, without quitting the spot, to serve the wants of respiration and open out on the surface of the fluid.

How rugged and coarse the works of man appear by the side of those of nature! Compare the instruments which the insect uses for its work with those which we employ. Behold its saws, its rakes, its brushes, its chisels; compare them with ours, and you will at once admit that all you know how to fabricate is only very inferior to what it possesses. The scalpel of the anatomist seems to have an edge of delicate workmanship; its polish attracts us; examine it with the microscope, and you are surprised to see it transformed into a coarse saw-blade. It is the same with the point of a needle; it becomes an imperfect awl. Scrutinize the scythes, the darts, or the rake of an insect, and everything there reveals the power of the Architect of so many marvels. The claw of the lion is immensely less complicated than that of the spider!

Talking by Touch.

In the creatures which we are now studying the tactile faculty acquires a marvelous development; it supplies the want of a language; the ants talk to each other by touch. One could not believe this if a careful observer had not demonstrated it, and yet the fact is so certain that any one can at any time verify it. When two of these intelligent insects meet in their career, we see that they touch each other differently with their antennæ, and that after doing this they seem to form some fresh resolution, in consequence of this tactile communication.

The following experiment, undertaken by Huber, gives incontestable evidence in favor of the fact. Having thrown a colony of ants into a closed and darkened chamber, he remarked that first they all scattered in disorder; but he soon noticed that if an individual in the course of his peregrinations discovered an outlet, he returned to the midst of the others; of these he touched a certain number, and after this mimic communication the whole population assembled in regular lines, which marched out under one common thought—that of freedom regained.

Telescopic Eyes.

In all the large animals there are but two eyes; in this respect the smallest insect is infinitely better provided than they are. The ant, the visual apparatus of which is one of the least perfect, possesses fifty. The common fly has 4000, and in certain butterflies many thousands have been counted. Each of these organs, too, presents, in microscopic proportions, the greatest part of the structures which help to form the globe of our eye. Closely packed together, these eyes make up for their immobility by their bulk, and this is so great that in some flies it almost covers the head, and even constitutes a fourth part of the weight of the body.

This powerful optic apparatus exhibits some curious modifications



CATERPILLARS ON THE MARCH: NEST, CHRYSALIS, COCOON AND BUTTERFLY.

which reveal the habits of insects. Those which seek their prey by night have their eyes more deeply set, in order better to absorb the least luminous rays. In the flesh-eating insects they are larger. In some aquatic species the head is furnished with several pairs, some directed upwards, others downward, in such a way, that while swimming on the surface of the water the animal can see at the same time the fish which menaces it from the depths, and the bird which is about to swoop down upon it. From the former it escapes by flight, and from the latter by diving.

Military Movements of Caterpillars.

Some insects, when they remove from their dwellings, observe a degree of order which is very remarkable. One species has become celebrated on account of the law which its larvæ constantly follow during their peregrinations. When the troop issues from the lair or sack in which the whole family have been sheltered in a mass, one caterpillar marches at the head; then come two; after that three; next four abreast, the squadrons always augmenting and marching regularly one after the other. Their files, which sometimes stretch out for a length of thirty to forty feet, in this way make numerous windings over the downs and roads, imitating the order of a procession in movement. This has procured for the butterfly which gives birth to this dangerous cohort the name of "processionary bombyx." When they are encountered, it is necessary to let them alone, for neither man nor animal can disturb their march, or even approach them without being severely punished for it. The hairs which cover these caterpillars become detached during their evolutions, and float all about the army; it is extremely dangerous to inhale them, for so soon as any enter the lungs, an obstinate and distressing cough ensues.

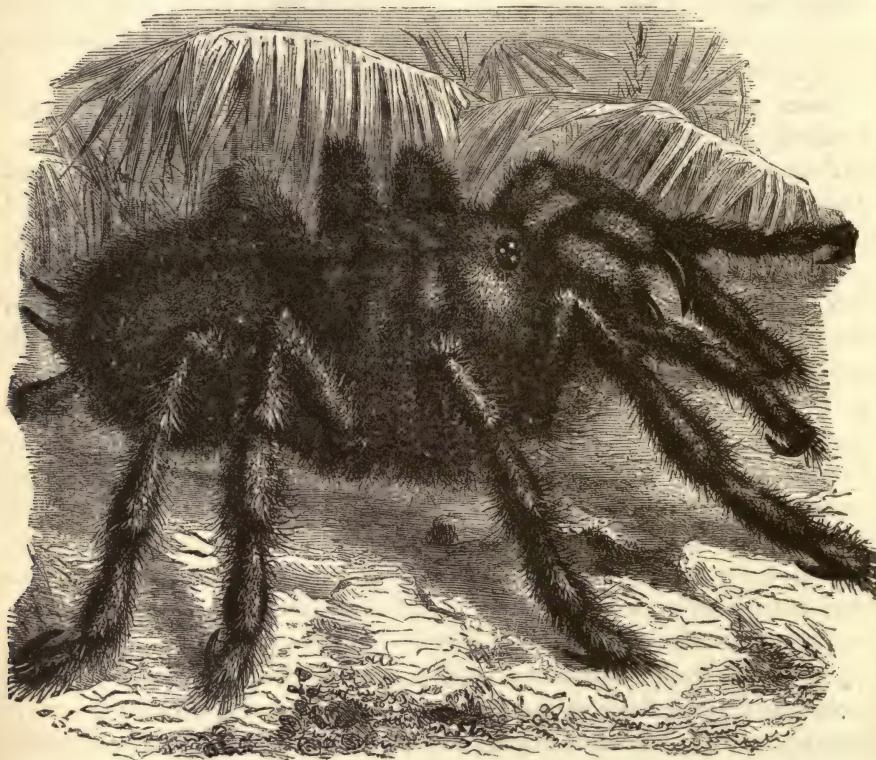
Insect Weavers.

Although Minerva, in her jealousy, broke the loom of Arachne, even though transformed into a spider, the obscure rival of the goddess nevertheless executes wonderful tasks. Some spiders are remarkable for the perfection of their weaving; in others the arrangement reveals the most astute intelligence. In the former category may be placed the regularly circular nets which the spiders of our gardens stretch from branch to branch; in the other the webs of the species which invade our dwellings.

These latter, usually built in the corners of the walls, exhibit a horizontal net soiled with dust, which is in a sense only the basement floor of the carnivorous insect's structure, for it is in the threads irregularly crossed above this that the prey gets entangled and lost. But the most ingenious part of this destructive engine is the lair in which the hunter lies ensconced. It is a veritable circular tunnel, with a double outlet and serving a double

purpose: one outlet is horizontal and opens upon the web; the other is vertical and gives passage below. It is from the former that the spider launches itself upon its prey; the other fills the office of a trap-door.

The spider takes the greatest care never to leave on its web the car-casses from which it has sucked the blood; such a charnel-house would alarm its living prey. So soon as a fly has been immolated, the insect seizes it, drags it to its tunnel, and ejects it by the lower opening. Thus



THE VORACIOUS CHICKEN-SPIDER.

when we look at the part of the floor below, we are astonished at the numbers that have fallen victims to the sanguinary spider. Sometimes also this hidden exit serves for it to escape by when menaced by some serious danger. But this is a very rare case; its special use, its exclusive purpose, is to receive the debris of the spider's repasts; a fact not noticed by any observer until a comparatively recent date.

The disgust inspired by the spider is not well founded. No insect possesses more intelligence or a more wonderful structure; the ugliness of

the ingenious Arachnis is forgotten so soon as we look at it without prejudice. The danger which alarms some persons is not well founded. It is true there are spiders the bite of which is as formidable as that of our vipers, but they only inhabit tropical countries. The spider found in cellars is the only one the bite of which can be considered as attended with danger, and the results of its bite, although some cases are related in which it has been fatal, are limited to a sharp pain and some swelling and inflammation. The notorious tarantula itself, when more closely studied, loses its strange prestige; its bite has ceased to produce the furious dancing mania so much spoken about, even in medical works.

Some well-known spiders, which are almost as large as the fist, sometimes fasten on chickens and pigeons, seizing them by the throat and killing them instantaneously, drinking their blood at the same time. Hence in Columbia, where these disagreeable guests are common enough, they are called chicken-spiders.

Slave-Holding Insects.

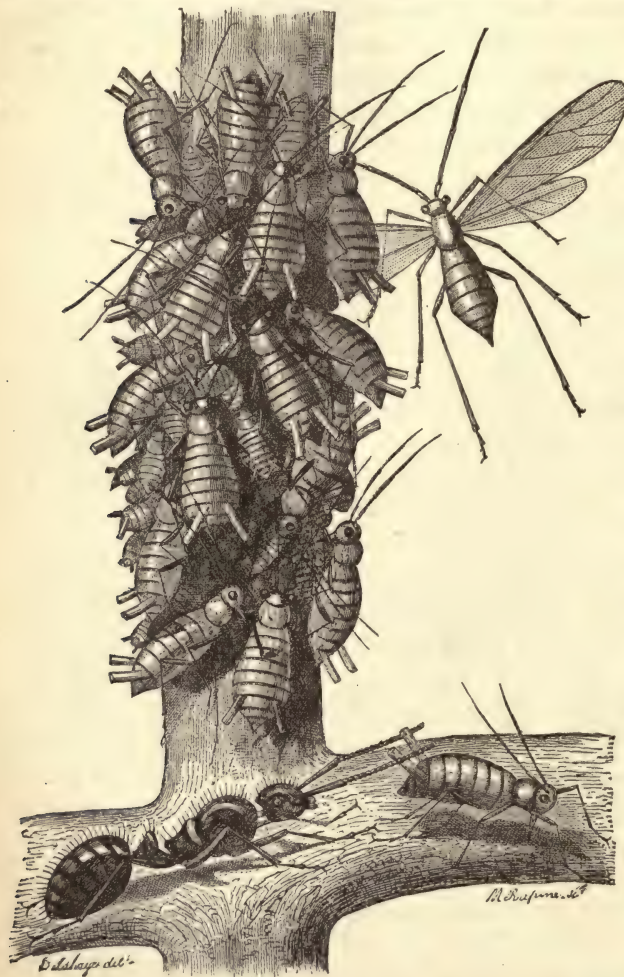
Strange as it may seem, there are insect tribes which bring others into subjection and lord it over their fellows, as if they were human beings. This is true of one species of ants. The ingenious Huber wanted to see how far the dependence of the two social classes went, and soon perceived that the chiefs, left to themselves, were absolutely unable to provide for their wants even in the midst of abundance. This naturalist having inclosed thirty Amazons with a plentiful provision of food, but without any slaves, saw that they fell into a state of profound apathy, although he placed the larvæ and nymphs alongside of them in order to stimulate them to work. All occupation ceased immediately, and the recluses would every one have died of hunger rather than eat alone. Many had already succumbed, when it entered the head of the Genevese savant to furnish them with a slave. She was scarcely introduced among the dead and dying when she was at work, giving food to the survivors, lavishing her care upon the young larvæ, and constructing shelter for them. She saved the colony. Nothing can be more incredible than these facts, and yet they have been verified with the most scrupulous care.

But the extraordinary customs of these ants differ somewhat according to the localities which they inhabit, and the number of slaves which the nest contains. In Switzerland Huber observed that the slaves generally work at the construction of the dwelling inhabited by the tribe, and that, like vigilant gatekeepers, they open the outlets at daybreak, and carefully close them when evening or a storm of rain comes on,

All kinds of ants do not so easily adapt themselves to slavery. There are some very small ones, such as the yellow ant, which set the Amazons at defiance, and although much weaker, frighten them by their mien: courage supplies the want of strength. Hence the blood-red ant, which is one of the most thorough-going slave-makers we are acquainted with,

never attempts to plunder the dwelling of the yellow ant, which fights with fury to defend its home, its family and its liberty. This is so constantly the case that one naturalist, to his great surprise, found a little tribe of this valiant species under a stone close to a nest of slave-makers. They knew how to make themselves respected there, and even frightened the others by their war-like attitude.

The slave-making tribes are not occupied solely with the capture of slaves; they frequently spread out over plants in order to carry off the



ANT ABOUT TO MILK APHIDES.

aphides. These are their cattle, their milch-cows, their goats; people would never have thought that ants were a pastoral race. They are extremely fond of a sweet liquor which distils from two little teats which the aphid carries at the extremity of its back. We often find them

scattered over the surface of vegetables sucking this fluid from individuals by turns as they encounter them. At other times, accompanied by their slaves, they carry off the aphides, and imprison them in their dwelling, in order to milk them at leisure, and there they are nourished exactly like stalled animals.

Huber discovered that the ants are so greedy after this sweet liquor, that to procure it more conveniently they make covered ways which lead from their nests to the plants inhabited by these miniature cows. Sometimes they carry their foresight even to a more incredible extent. In order to reap a richer harvest from the aphides, they leave them on the plants which they habitually feed upon, and with finely-tempered earth build them a species of little stables in which they imprison them.

Architects and Destroyers of Towns.

If we transport ourselves to tropical regions, where nature, more vigorous, multiplies on every side the sources of life, we see insects disputing with man for every foot of possession. They make a regular war of it, invading his plantations or his dwelling—a savage pitiless war—which must at times be decided by the cannon. This is the case with the warrior-ant in the neighborhood of the Cape of Good Hope, which has attracted the attention of every traveller by its extraordinary buildings, and the havoc it makes.

These termites, or white ants, as they are frequently though wrongly called, live in republics composed of different sorts of individuals: the males, which have wings; and the workmen, soldiers, and queens, which have none. The workmen are only occupied in constructing buildings. The mission of the soldiers is to defend the colony and maintain order. Lastly come the females, true queens, worshipped by the whole population which look to them for the continuance of their race. They are only monstrous egg-sacks; regular egg-laying machines of the most astonishing fecundity.

The dimensions and solidity of the nests of the warrior termites, compared to the weakness of the insect, have always excited the astonishment of travellers. They are sometimes twenty feet in height. Their pyramidal form gives them the look of a colossal sugar-loaf enlarged at the base, the flanks of which are roughened by little accessory hillocks. When one traverses a part where the colonies of termites abound, one might take them at a distance for an Indian village. The walls of these dwellings are so solid, that the wild cattle climb upon them without crushing them when they place themselves there as sentinels; and the interior contains

chambers so large, that a dozen men can find shelter in some of them; the hunters place themselves in them to lie in wait for wild animals.

Man's Architecture Outdone.

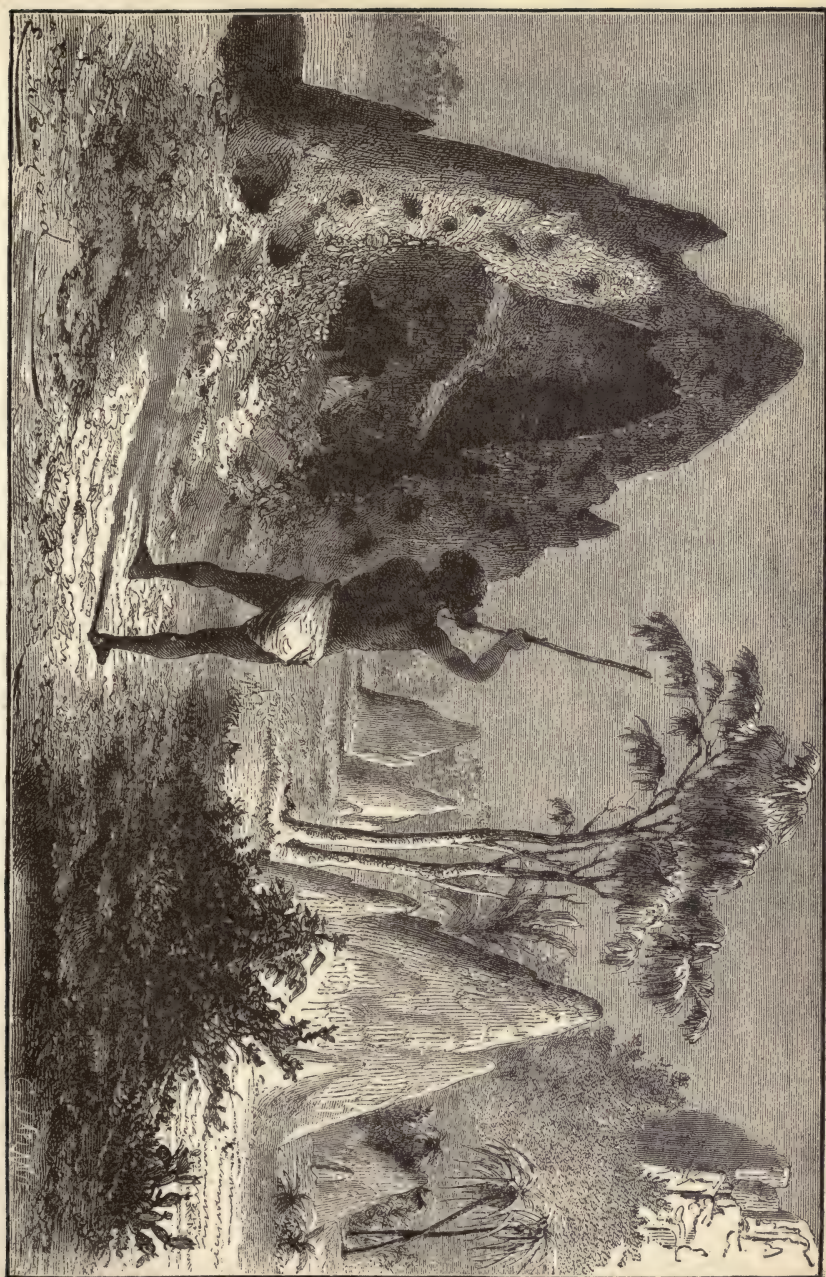
Besides these extraordinary chambers, we find also in this kind of social-republic city long galleries, of the calibre of our large cannon, and which extend as much as three or four feet into the ground. The monuments of which we are proud are trifling matters compared to those built by these fragile insects. The nests of the termites are often 500 times as long as their bodies, and it has therefore been calculated, that if we gave our houses a proportional height, they would be four or five times as high as the pyramids of Egypt.

Other termites, instead of constructing these astonishing abodes, occupy themselves mischievously in attacking those of men, and invade them sometimes from the roof to the foundation; everything then goes to ruin, house and furniture alike. These insidious depredators make their way silently underground, and tunnel long galleries, by means of which they all at once invade the dwellings. Then they penetrate into all the timber-work, and totally destroy the interior of it, only leaving a surface as thin as a wafer. Nothing reveals their hidden havoc to the eye; we see our house, we believe in its real existence, while we possess only a phantom of it—a house of cards which falls at the first shake. Smeathman, who has left us such an interesting history of these creatures, relates that they sometimes destroy large towns, which have been deserted by their inhabitants.

A lady resident says that in the districts of Africa where she lived, the termites only take a very short time to devour an entire dwelling. A staircase of very fair size is eaten in a fortnight; tables, arm-chairs, and chairs in much less. Often at Sierra Leone, on returning to one's house after a short absence, only the ghost of the furniture is to be found. The exterior still possesses all its freshness, but the substance is gone, and every piece that is hollowed out falls to powder beneath the hand of any one who touches it, or under the weight of any one who sits down upon it.

Nests Laid Out with Streets and Canals.

Instead of the conical domes ornamented with little bell-towers, grouped together in villages in the middle of the plains, some species of this group, such as the tree-termite, prefer to suspend their nests amid the large branches of the strongest trees. These aerial masses, mingling with the foliage of the trees, are very striking, for some of them are larger than our hogsheads. The nests, which are extremely porous, present inside an **inextricable** labyrinth of tortuous canals; they are formed of a matrix or



VILLAGE BUILT BY WARRIOR ANTS.

compact paste composed of fine particles of wood, gum, and juices of plants.

For some years past two species of this kind have been established in France, and have caused very serious havoc. The devouring cohorts of the light-shunning termite have invaded several towns, where their fangs have completely undermined a number of houses which have fallen in. At one time these hateful depredators set to work to gnaw the prefecture of La Rochelle and the archives, without any person suspecting it; wainscotting, pasteboard, papers, were all annihilated without any external sign of this havoc appearing. At present the papers of the bureaux are only preserved by keeping them in zinc boxes. At another place the termites, having gnawed away the props of a dining-room without its being perceived, the flooring collapsed during a party, and the entertainer and his guests sank through.

In tropical regions there are ants of other species which are not less to be dreaded than the devouring termites. They do not annihilate houses, but they invade the fields and build there enormous nests which look like so many little mountains fifteen to twenty feet high. They multiply to such an extent in certain plantations, that the colonist is obliged to abandon them. Sometimes, however, he resists the invaders, declares a war of extermination against them, and fires their dwellings by the aid of some combustible materials. Sometimes artillery charged with grape-shot is employed to overthrow the lofty ramparts of these ants, and scatter both the ruins and the architects.

Thus is man obliged to attack an insect with the cannon. Sometimes he resorts to the mine, a step he is compelled to take against certain winged ants in the tropical countries, which sink their nests twenty-five feet in the ground, and these are so compact that they can only be torn up by the aid of powder, and by overturning all the earth round about them. Müller relates that in Brazil, entire provinces on the banks of the Parana have been in this way transformed almost into deserts.



CHAPTER XX.

MUSEUM OF REMARKABLE INSECTS.

Anatomy of Insects Superior to that of Man—Curiously Formed Eggs—Lifting the Lid and Stepping Out—Not Taking the Trouble to be Born—Eggs Exquisitely Decorated—Sexless Insects—Flying Lamps—Insects Illuminating Dwellings—Brilliant Appearances—Beetles—The Sacred Beetle of Egypt—Insect Undertaker—Death Watch—Droll Superstition—Hercules Beetle—Six Years' Imprisonment—The House Cricket—Poet's Address—Ship Saved by a Cricket—How the Chirping is Done—Wings Without Flight—The Spider's Web—Ingenious Mechanism—Water Spider—How Air is Obtained—A Complete Diving Bell—Rapacious Bird Spider—Females Practicing Cannibalism on their Husbands—Children Devouring Mothers—Thread of Myriads of Fibres—The Great Moth Family—Death's-Head Moth—Fungus Growing on an Insect's Head—Ravagers of the Forest—Visit to the Woods—Whirlwind of Fire—Waging Organized War on Moths—Incalculable Destruction by Mites—Stenographers, Carpenters, Joiners, Carvers among Insects—Wood-Boring Goat Moth—Making a Place for Eggs—The Historic Locust—Ravages in the West—Flights of Devastation—Where Locusts Come From—Devouring One Another—Rapid Growth of Young—Orchestra of Strange Instruments—Return after Seventeen Years—No Forgetfulness—Ephemera—Creatures of a Day Described—Bees and their Remarkable Habits—Insect Intelligence.



OUR heart, the structure of which is so admired and so admirable, is nevertheless only a very coarse forcing-pump compared with that of an insect. All the apparatus of the central organ of circulation is limited to two large openings, each furnished with two valves or valvelets, intended to prevent the reflux of the blood; but if, by the aid of the solar microscope, we project all the transparent body of an insect upon a huge screen, one is astonished at the magnificent spectacle offered by the movement of the blood.

The heart is represented by a long vessel which occupies all the back of the animal, and into which the circulating fluid precipitates itself by eight or ten lateral openings, like small streams converging towards a more impetuous current. Enough valves rise and fall to allow entrance to the fluid and hinder its return. In the interior of this lengthened heart larger valvules, to the number of six or eight, are folded back against the wall to let the blood pass forward, and re-open directly afterwards, during each contraction, in order to prevent its flowing backwards. Vessels arranged in loops are distributed to all the members.

The course of the blood in the colossal insect seen upon the screen resembles so many little streams bearing globules more or less heaped up; this is proved by the strictest evidence, and yet who would believe that Cuvier and his school would never credit this phenomenon? Instead of looking, which was so easy, they preferred to deny the circulation in the insect, and to regard its wonderful heart as a simple secreting vessel shaken by contractile shocks. It is thus that physiological science advances; a hundred battles are requisite to make men admit the most easily verified truth.

This extraordinary construction extends even to the eggs of insects. There are some, the extremity of which is surmounted by a crown of points; others exactly represent a delicate miniature saucepan, the young inhabitant of which, in order to be born, has only to lift up the lid.

The egg of the louse, which disgusts us so much, presents this curious structure, but in addition its opening is embellished by a little projecting rim, and a groove into which the edge of the cover enters in such a manner as to close it air-tight. A still more ingenious mechanism is seen in some of the wood-bugs. The young insect does not even require to lift the lid; there is within a regular spring on which this office devolves; at the moment of birth he has only to emerge, and one may say with justice of him, that he does not even take the trouble to be born.

Eggs Painted and Delicately Engraved.

The surface of these eggs is often remarkable on account of the exquisite fineness of its entwined ornamenting. Some are covered with large ribs which extend from one end to the other; others display only fine lines artistically engraved; others again have the surface covered with a mesh of lace. For them nature has exhausted the riches of her palette; they are dyed with the sweetest or the most glittering tints of blue, green, and red; some absolutely resemble mother-of-pearl, and there are some that one might take for so many charming little pearls.

The sexuality itself of insects offers some curious particulars. There are not only males and females among them, but some of their republics have, in addition, individuals absolutely deprived of sex; these are the neuters, which alone work and constitute the element of their prosperity and power. Some are true workmen, others valiant soldiers. But these individuals, which we recognize by their form or their particular weapons, are in truth only aborted females; the bees themselves know this perfectly.

To all these marvels of insect life we must yet add the inexplicable phenomenon of the dazzling light which they project into the midst of darkness, which sometimes in their flight furrows the air with long

streams of fire, and sometimes peacefully illuminates the foliage on which they repose.

Every person knows the glow-worm which in the autumn gives our green turf the appearance of a starry heaven. But in South America there are phosphorescent insects of far superior splendor. The great lantern-fly can supply the place of a lamp with the bright light with which its monstrous head gleams. A female traveller relates that at Surinam she sometimes read the newspapers by the aid of a single one of these flying lamps.

Living Lamps in Dwellings.

In the Antilles the phosphorescence of these insects is even made daily use of; they employ there a luminous beetle the corslet of which becomes dazzling in the gloom. In Cuba the women often inclose several of them in little cages of glass or wood, which they hang up in their rooms, and this living lustre throws out sufficient light to serve to work by. Travellers there also, in a difficult road, light their path in the middle of the night by attaching one of these beetles to each of their feet. The creoles sometimes set them in the curls of the hair, where, like resplendent jewels, they give a most fairy-like aspect to their heads. The negroes at their nocturnal dances scatter these brilliant insects over the robes of lace which nature provides for them, all woven from the bark of the lagetto. In their rapid and lascivious movements they seem enveloped in a robe of fire. It is the conflagration of Dejanira without the horror.

The perfect female of a beetle, destitute of wings and elytra, with which the male fly is furnished, kindles her light, which issues from the last three segments of her body, and is of a beautiful sulphur color, and always puts it out between eleven and twelve o'clock, shining no more for the rest of the night.

A very extensive group of beetles is known by about 2,000 species in the collections of naturalists. They are distinguished from others by peculiarities of the antennæ, which terminate in a large club or knob, and this also varies considerably in form. To this genus belongs the sacred beetle of the Egyptians. It is about one inch long, or rather more, and of a black color. It is met with not only in Egypt, but in the south of France, Spain, and Italy, and seems to be diffused all over Africa, as far south as the Cape of Good Hope. The ancient Egyptians held that it was sacred to the sun; and, regarding it as typical of that luminary, which is the source of light, heat, and all abundance, looked upon it as the emblem of fertility in general. Representations of it are frequent among

their hieroglyphics, and sculptured images of it are found on their rings, necklaces, and other ornaments. It was even embalmed with them after death.

A laborious task is performed by an insect by no means uncommon in some localities called the burying beetle. Gleditsch, a foreign naturalist, had often remarked that dead moles, when laid upon the ground, and especially if upon loose earth, were almost sure to disappear in the course of two or three days, and often of twelve hours. To ascertain the cause he placed a mole on one of the beds of his garden. It had disappeared by the third morning; and on digging where it had been laid, he found it buried to the depth of three inches, and under it four beetles, which seemed to be the agents in this singular interment. Not perceiving anything particular in the mole, he buried it again; and on examining it at the end of six days, he found it swarmed with the offspring of the beetles, which he naturally concluded had buried the carcass for food to supply their future young.

A Beetle that is an Undertaker.

To place this beyond doubt, he continued his experiment, and in fifty days four beetles had buried, in a small space of earth, four frogs, three small birds, two fishes, one mole, and two grasshoppers, besides the entrails of a fish, and two morsels of the lungs of an ox, all evidently intended for the same purpose.

The superstitious fancy of the death-watch has arisen from the sounds emitted by one species of beetles. A recent writer remarks: "All that has been related of the heroic constancy of the American savages when taken and tortured by their enemies, scarcely comes up to that which these little creatures exhibit. You may maim them, pull them limb from limb, roast them alive over a slow fire, but you will not gain your end: not a joint will they move, nor show by the least symptom that they suffer pain. Do not think, however, that I have tried these experiments upon them myself, or that I recommend you to do the same." One species was observed by Latreille to produce the sound called the "death-tick," by striking its jaws upon wood. On this occasion it was immediately answered from within by a precisely similar sound.

The stag beetles are chiefly found in rotten and decayed wood and under the bark of trees, where they remain concealed during the day, flying about and feeding on the leaves only in the evening. The month of July is the time, during which they are principally seen. The males have great strength in their mandibles, or jaws, with which they are able to pinch quite severely. Stag beetles may be kept alive for a considerable time, if supplied with the fresh leaves of oak or willow or with sweetened water. Frequently



EUROPEAN CHIRPING CRICKET.

several of their heads are found near together and alive, while the trunks and abdomens are nowhere to be seen. This must be the result of severe battles, which at times take place among these, the fiercest of the insect tribe. They do not fly until most of the birds have retired to rest.

The females deposit their eggs in worm-eaten or decayed trees. The larvæ, which are round and whitish with rust-colored head and legs, are nourished under the bark. In this state they pass six years. When about to undergo their change into a chrysalis, each insect forms a hard and solid ball of the form of an egg. When the perfect insect issues forth, it is at first quite soft. The largest of this family is the hercules beetle. It is a native of tropical America.

The Common House-Cricket.

This insect is found throughout the temperate zone ; it frequents houses, and prefers the vicinity of fires. The address of the poet to this creature is very pleasing :

Little inmate, full of mirth,
Chirping on my kitchen hearth,
Wheresoe'er be thine abode,
Always harbinger of good,
Pay me for thy warm retreat,
With a song more soft and sweet ;
In return thou shalt receive
Such a strain as I can give.
Thus thy praise shall be express'd
Inoffensive, welcome guest !
While the rat is on the scout,
And the mouse with curious snout,
With what vermin else infest
Every dish, and spoil the best ;
Frisking thus before the fire,
Thou hast all thy heart's desire.
Though in voice and shape they be
Form'd as if akin to thee,
Thou surpassest, happier far,
Happiest grasshoppers that are ;
Theirs is but a summer's song,
Thine endures the winter long,
Unimpaired, and shrill, and clear,
Melody throughout the year.

The celebrated naturalists, Linnæus and Bonnet, were disposed to consider insects as deaf ; but the knowledge of Shakespeare was more accurate when he made Mamilius say :

I will tell it softly,
Yon crickets shall not hear it.

As soon as it becomes dark, the chirping of crickets increases, and they come running forth, often in great numbers, from the size of a flea to that of their full stature. The instrument on which the male plays consists of strong, rough strings in the wing-cases, by the friction of which against each other a sound is produced and communicated to the membranes stretched between them, in the same way that the finger produces vibrations on a tambourine, which are diffused over its surface.

To most people, the chirp of the cricket conveys to the mind the idea of a perfectly happy being. Thus, to the Prince's question, "Shall we be merry?" Poinciana answers, "As merry as crickets." The learned Scaliger took such a fancy to their song, that he was accustomed to keep them in a box in his study. Osbeck states that the Spaniards confine some insects of an allied genus, in cages, for the sake of their song, and in some parts of Africa, it is said, the common house-crickets are kept and fed in a kind of iron oven, and sold to the natives, who like their chirp, and consider it a great soporific.

A Cricket Saves a Vessel from Shipwreck.

On one occasion, according to Southey, the song of an insect of this genus was the means of saving a vessel from shipwreck. The incident occurred in the voyage of Cabeza de Vara towards Brazil. When they had crossed the line, the state of the water was inquired into, and it was found that of a hundred casks there remained but three, to supply four hundred men and thirty horses. Upon this, the captain gave orders to make the nearest land. Three days they stood towards it. A soldier, who set out in ill-health, had brought a grillo, or ground cricket, with him from Cadiz, thinking to be amused by the insect's voice; but it had been silent the whole way, to his no little disappointment. Now, on the fourth morning, the grillo began to sing its shrill rattle, scenting, as was immediately supposed, the land. Such was the miserable watch that had been kept, that upon looking out at the warning, they perceived high rocks within bow-shot, against which, if it had not been for the insect, they must inevitably have been lost. They had just time to drop anchor. From hence they coasted along, the grillo singing every night, as if it had been on shore, till they reached the island of St. Catalina.

Like many noisy persons, crickets like to hear nobody louder than themselves. Ledelius relates that a woman, who had tried in vain every method she could think of to banish them from her house, at last got rid of them by the noise made by drums and trumpets, which she had procured to entertain her guests at a wedding. They instantly forsook the house, and she heard of them no more.

Brunelli, an Italian naturalist, kept several field-cricket in a chamber. They continued their crinking song through the whole day, but the moment they heard a knock at the door they were silent. He subsequently invented a method of imitating their sounds, and when he did so outside the door, at first a few would venture on a soft whisper, and by-and-by, the whole party burst out in chorus to answer him; but on repeating the rap at the door, they instantly stopped again, as if alarmed. He likewise confined a male in one side of his garden, while he put a female in the other at liberty, which began to leap as soon as she heard the crink of the male, and immediately came to him—an experiment which Brunelli frequently repeated with the same result.

The common house-cricket of Europe is about an inch long, of a yellowish or clay color mixed with brown; it dwells in the cracks of walls and floors and in the vicinity of warm places, where it remains during the day, coming forth at night in search of food. It is a most indefatigable musician commencing its tune at twilight and keeping it up till day-light. This tune is produced by rubbing the hard internal border of one wing cover against a horny ridge on the under surface of the other.

There are several species of crickets in America. Though these insects are furnished with long legs behind and brawny thighs adapted for leaping, yet, when driven from their holes, they show no activity, but crawl along in so lifeless a manner, as easily to be caught; and though they are provided with a curious apparatus of wings, they never exert them even when there seems to be the greatest occasion for it.

Amazing Mechanism of the Spider's Web.

Slight and even simple as the threads of the spider may appear, they are not so in reality; and this forms one of the many examples in which the eye of the naturalist discovers some concealed elegance or complex mechanism, which, though daily visible, is concealed from those

Who walk through nature with their half-shut eyes.

It has been incontestably shown that a spider's thread, even spun by the smallest species, and when so fine that it is almost imperceptible to our senses, is not, as we suppose, a single line. A spider has a spinneret, showing several little projections, each of which contains a great many tubes, so that a space often no larger than the pointed end of a pin has one thousand of them.

From each of these tubes, consisting of two pieces, the last of which has an exceedingly fine point, an amazingly slender thread proceeds, which immediately after unites with all the other threads, so that one only may be formed. Thus, from each spinner there issues a compound

thread, and these fine threads, at about a tenth of an inch from the point of the spinners, again unite and form the cordage of the spider's web, each of which is composed of hundreds of fibres.

Looking into a large glass globe, filled with water, in which are immersed several portions of aquatic vegetables, some floating on the surface and some lying at the bottom, there may sometimes be seen amongst the blades of grass and bits of reed, a sort of purse, closely resembling in shape and size a pigeon's egg, but pierced transversely through the middle. It is filled with air, and perfectly closed, except in its lower part, where there is an aperture just sufficient for the ingress and egress of a very small spider. A strong and semi-transparent substance, resembling white gauze, forms the texture of the bell, firmly moored and anchored to the submerged plants by threads and cables, which hinder it from mounting to the surface.

Watch the lady of the mansion coming out of her retreat. Her length is about one-eighth of an inch, her body is brown, and upon the upper part of the back is drawn a dark patch, having four little dots on its centre. This spider lives under water, and yet requires air to breathe. Her Maker has taught her how to solve a problem which would have baffled the genius of Newton.

An Insect Diving Bell Supplied with Air.

She swims on her back, and her abdomen is enveloped in a bubble of air, which, reflecting the prismatic colors, looks like transparent mother-of-pearl. She then rises to the surface of the water, and elevates above it the lower portion of her body. Once on the surface, she breathes strongly, inhales as much air as she possibly can; then she gets beneath the water, and gives out gently the liquid particles with which her lungs are gorged to excess. The long, silky, clammy threads which cover her retain in its place around her the bubble with which she is surrounded. This done, she dives with precaution, and carries into her nest a provision of air, to replace what she had consumed.

When once ensconced in her nest, she lies in ambush, with her cunning little head lowered, watching for any prey that may chance to pass. Woe to the tiny worm that wriggles on the stalk near her den! She darts forward, seizes him, and bears him off to her bed of impermeable gauze. Curious, indeed, is that little dwelling. While it was in process of making, it was naturally filled with water; but when once the work was ended, it became necessary to expel the water, and replace it by atmospheric air. To attain this end the spider had to make more than a hundred trips to the surface. Each bubble that she introduced mounted towards the top

by its specific lightness, displacing an equal quantity of water, which was forced out through the orifice below, until the bell contained nothing but air.

Numerous and various are the mason spiders ; but the one remarkable species is found in the south of France. She usually selects for her nest a place bare of grass, sloping in such a manner as to carry off the water, and of a firm soil, without rocks or small stones. She digs a nest a foot

or two in depth, and of a diameter equal throughout, sufficient to admit of her easily passing. She lines this with a tapestry of silk, glued to the walls. The door, which is circular, is constructed of many layers of earth kneaded and bound together with silk. Externally, it is flat and rough, corresponding to the earth around the entrance, for the purpose, no doubt, of concealment ; on the



THE MASON SPIDER.

inside it is convex, and tapestried thickly with a web of fine silk.

The threads of this door-tapestry are prolonged, and strongly attached to the upper side of the entrance, forming an excellent hinge, which, when pushed open by the spider, shuts again by its own weight, without the aid of spring hinges. When the spider is at home, and her door forcibly opened, she pulls it strongly inwards, and even when half opened often snatches it out of the hand ; but, when she is foiled in this, she retreats to the bottom of her nest, as the last resource.

Spiders are found in every habitable portion of the globe, but are largest in warm climates. The males and females live separately and the latter are most frequently seen and are the larger. All are carnivorous, devouring living prey, sucking the juices and sometimes swallowing the fragments. The females are generally ready to attack and feed on the males, even in the reproducing season, and both sexes are fond of fighting, the vanquished being devoured. They are very cleanly and spend much time in cleaning their limbs from dirt by the toothed combs and brushes on the mandibles. In making their webs, they accommodate themselves to circumstances, displaying great perseverance, ingenuity and almost intelligence.

They carefully guard their eggs, sometimes carrying about with them the silken bag, which contains them, and are affectionate to their young, which in some cases devour their mother. They descend by their silken threads—head downward, but climb up on them head upward, rolling them into a bundle during the ascent. The thread cannot be used the second time for the same purpose. The genus *mygale* contains the largest of the spiders. The crab—or bird-spider of South America—is about three inches long. Its body is very hairy and blackish. It is very powerful, jumping upon and killing small birds, and spins no web.

The Great Moth Tribes.

Like the owl, which so much resembles many of them in style of plumage, the moths generally remain concealed in their retreats during the day, quietly reposing till the growing darkness calls them forth to visit the dewy flowers, and revel in the enjoyment of existence, till the dawning day drives them to their wonted lurking-places.

This law of nocturnal life has, however, its exceptions, for we find one family to consist of species which are active only on the approach of evening or early in the morning, a few being as diurnal as the butterfly, and flitting in broad day from flower to flower in quest of honeyed food. This is the family of the sphinxes, or hawk-moths.

These insects are remarkable for their size, and the extent of their wings, which are extremely vigorous, and well adapted for rapid flight. Their name of hawk-moth was derived from the resemblance of their progression through the air to that of a hawk; but it is greater to that of some of the humming-birds. The remarkable attitude often assumed by the caterpillars, resembling that of the fabulous sphinx of the ancients, suggested to Linnæus the scientific term by which they are still denominated.

The death's head hawk-moth appears to be distributed over England,



GREEDY BIRD-SPIDER DEVOURING ITS VICTIM.

and Europe generally. Its thorax, so singularly bearing the figure of a human skull, has rendered it an object of terror to the superstitious. It varies from four to five inches in the expanse of its wings. The upper pair are brown, varied with black; the disk is marked with undulating lines of black patches, and powdered with white; the hind wings are dull orange.

One of the most puzzling sounds to the inquirer is that of the death's-head moth, when it is caught and kept a prisoner. Sometimes it is like that of a mouse, but much more piteous. Reaumur, after mentioning many experiments, concludes with the conviction that "in the more minute part of nature's works there is always something which we cannot explain." He thought it most probable that the cry came from the head, perhaps from the mouth, or rather from the tongue, and it might be by the friction of the feelers against the tongue; for when he unfolded the spiral tongue with a pin, the cry ceased, but it was renewed the instant it was coiled up again between the feelers. He then prevented the palpi from touching the tongue, which also stopped the sound, and when only one was permitted to touch it, the sound was much more feeble.

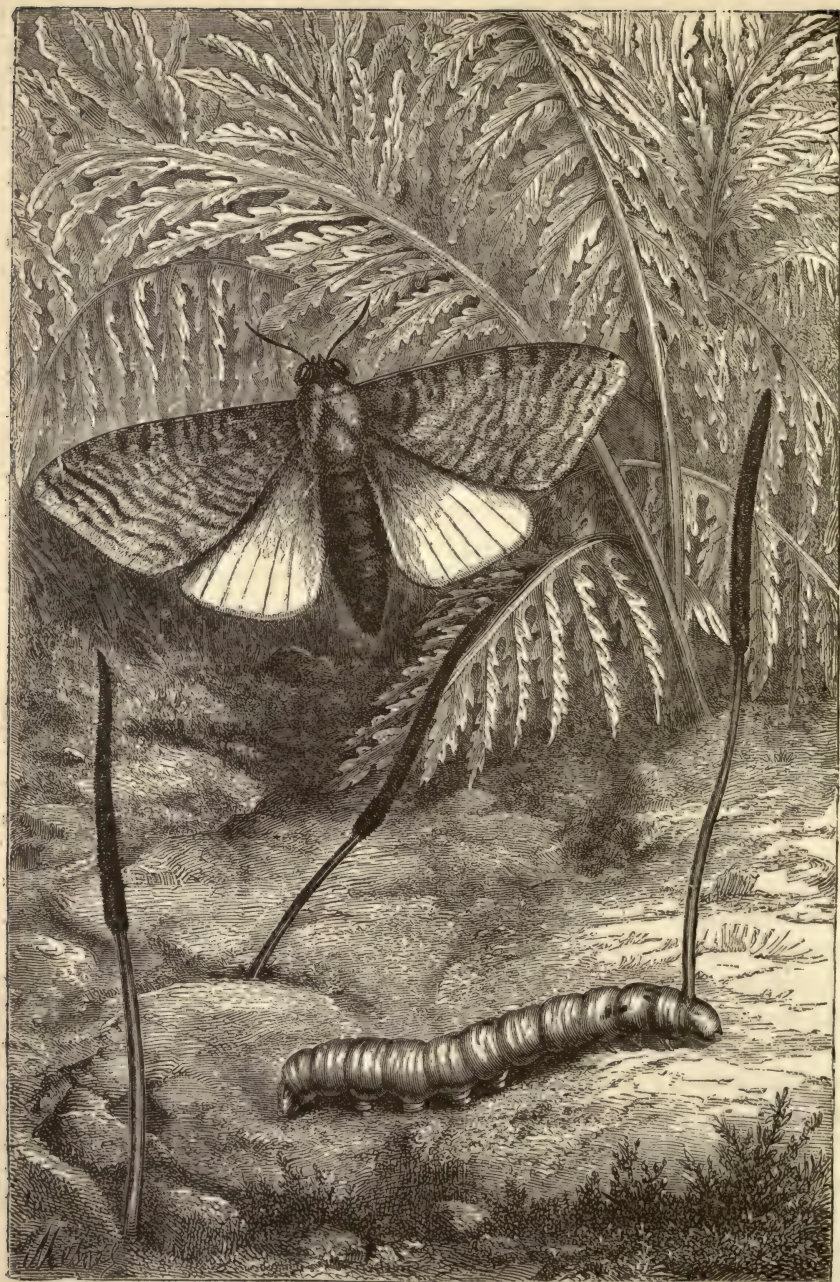
The Animal with a Vegetable Head.

That there are more things in heaven and earth than are dreamed of in our philosophy, is abundantly proven by a study of natural history. We come upon surprises the further we pursue our investigations. Who would have believed, without the actual demonstration of the fact, that there could be a union between a living moth, an insect, and a vegetable growth?

A fungus is known which never grows except on the bodies of dead spiders; another only appears on the surface of horses' hoofs in a state of putrefaction. One little parasite of the same family, the *isaria* of the sphynx, has hitherto only been observed on certain nocturnal moths. Still more curious facts are known; for instance, that of a fungus never found only on the neck of a caterpillar of tropical countries. It is always solitary on this, and of enormous size in proportion, being often four or five inches high. Another species of fungus is an outgrowth from the head of the New Zealand moth in its larvæ state, as represented in our engraving, which conveys an accurate idea of one of the most astounding discoveries in the insect world.

Ravagers of Forests.

In considering those creatures which work fearful destruction on vegetable life, we naturally expect to see animals on the stage, the bulk of which must be in proportion to their formidable powers of devastation,



(526) NEW ZEALAND MOTH, WITH FUNGUS PLUME.

but it is quite the contrary. It is not the auroch with its shaggy mane, nor the powerful stag, nor the wild boar that ravages or destroys our forests, but tiny insects which slaughter its aged trees.

If, when the warm breath of spring drives away the rigor of winter and renews life in the fields, we enter one of the great coniferous woods of the continent of Europe, we are astonished at the tumult and activity which prevail in lieu of the silence we went there to seek. Everything is in movement.

Groups of woodmen, foresters, and overseers move about by hundreds, and stretch away like columns of skirmishers; it is a complete army in the field, which opens out wherever there is a large space, and of which the wings are sometimes lost in the windings of the roads, or hidden by the projection of some hillock. This mass of men always moves in order, distributed in troops commanded by experienced leaders. They are all provided with long weapons, which at a distance might be taken for lances.

Elsewhere, again, we find a lengthy train of pioneers regularly posted, and vanishing in the distance, all animated with feverish activity, are hollowing out the soil, and making, for many leagues, long trenches which follow the roads and serve to isolate the different districts of the forest from one another.

Forests Wrapped in Glaring Flames.

Or if the excursion be made by night, another spectacle awaits us. The whole forest seems to be on fire. In every part are burning great trees, erect and isolated, like huge threatening torches, the flame of which rises to the clouds and casts a baleful glare on all around. A few foresters, standing in silence, contemplate the progress of the conflagration, and watch its ravages. Lastly, at other times, as a final resource, the entire forest is given up a prey to the flames, and whirlwinds of fire, menacing and dreadful, spread on every side; a woody region, formerly so fertile, is entirely devoured by fire and only an immense mountain of charcoal remains of all this mass of wealth.

We ask against what formidable enemy such an army of men has been launched! Who are they going to attack with their rods which they brandish on all sides? What redoubtable aggressors are the others attempting to stay the march of, with the long trenches they are scooping out? Why these frightful fires in the middle of the night? Why this general conflagration?

This formidable enemy is at times only a single insect, but it menaces everything with its destructive tooth, and men prefer decimating the for-

est to losing it entirely. One is really stupefied at seeing so many and such energetic efforts directed solely against the progeny of a simple butterfly, but its caterpillars sometimes multiply to such an extent that it is necessary to exterminate them utterly in order to preserve the forest from ruin. In one part the woodmen and their families, who are called out *en masse*, are only occupied in crushing this deadly race upon the trees. In another the others are cutting off the infected districts by ditches, in order to check the invasion of the caterpillars, which, when they have devoured everything in one place, proceed in immense bands to invade the healthy localities.

But in spite of so much labor, man is sometimes vanquished by the insect, and there only remains one extreme resource—that of setting fire to the forest and burning the invaders. All this war of extinction, of which we have just given a succinct account, is only directed against a small number of our enemies, as for the most part they are able to evade the empire of the argiculturist, and their formidable army defies our weakness.

War Declared Against a Moth.

These great works are particularly undertaken against certain night-moths, for they are simple phalænæ, which are to be classed among the most destructive ravagers of the forests. They are attacked in their three different phases; their caterpillars are crushed as they climb the trees.

When after devouring a complete section of the wood, they pour forth in serried columns to attack a sound part, they fall into trenches hollowed out by the pioneers, and when they fill these, they are stifled in a heap by covering them over with earth. The great fires lighted at night are directed against nocturnal moths. The glare attracts them, and they are soon scorched by the flame in consequence of going too near it.

The pine bombyx enjoys the sad prerogative of being placed in the front rank of the enemies of our forests. It is the most hurtful insect to the tree of which it bears the name. It especially attacks wood from sixty to eighty years old, and many examples are known of forests at this age being totally destroyed by these caterpillars, which the German wood-growers call pine spinners, on account of the numerous cocoons with which they cover the leaves of this tree.

The foresters equally dread another moth, commonly called the monk or nun, on account of its robe being laced with black and white like that of certain devotees. It is all the more fatal because its caterpillar attacks



not only the coniferous forests, but in addition all forest trees, such as the birch, oak and beech. Its butterflies are met with in autumn, and sometimes in such abundance that at a distance one might take them for snow-flakes drifting about. The regular exterminations of which we have previously spoken, are also directed against this monk bombyx.

Havoc by Tiny Creatures.

Among the butterflies, the progeny of which devastates our woods, it is necessary to mention also the pine-eating species. Its caterpillars, which sometimes multiply in an extraordinary way, make great havoc in the pine forests. They are particularly to be dreaded, because they show themselves very early, and devour the young shoots. They are met with the same means as the others; their invasion is checked by trenches, and in some places by herds of pigs which eat them in heaps. For this purpose the pigs are sent to the forests towards the month of August, a time at which they seize the caterpillars as they descend from the trees in order to hibernate under the moss or earth.

Other insects, in lieu of attacking stems or leaves, attach themselves to the buds. One of them produces great havoc by gnawing those of the pine. Its caterpillar, which is very small, being introduced beneath the scales of the bud, gnaws a part of it in such a way that the stalk, warped at the very core, loses its straightness, twists, and becomes deformed. We can see from a distance when these artisans have assailed a part of a wood, by the strange aspect which the tops of the trees present. All the terminal buds are more or less contorted, instead of possessing their normal direction. It is to this result that the species owes its name of pine-twister, by which the foresters generally designate it.

Some destroyers, instead of this openly declared war, operate silently and in the shade; these are concealed enemies, which nothing can track, and we do not suspect their presence till they have slain their victim. Some live on wood and hollow out ample tortuous galleries in it, which very speedily modify the organism of the tree so profoundly, that the strongest succumb to it. Others work between the bark and the sapwood, using up materials that offer less resistance to their teeth.

Insect Typographers and Stenographers.

In the former category must be placed the cossi, those enthusiastic carpenters. Another, again, is the oak bombyx, the caterpillar of which is accustomed to follow a straightforward track in the centre of the young boughs in our forest trees.

In the second category may be ranked the numerous legion of typographers and stenographers, so called from the character of the chisel-

lings with which they so deplorably ornament the surface of wood. Each species invariably draws the same design, so that we can always discover the workman by his work without seeing what enemy we have to deal with.

Almost all these laborers are of very small size. Their teeth, with deadly quickness, cut numerous galleries between the wood and the bark, invading both parts at the same time. These tiny ravagers are often not more than about the sixth of an inch long, and hence as their bodies are slender in proportion, they only require a very narrow trench to promenade in at their ease. Nevertheless, as each insect procreates to a great extent, the number of galleries hollowed out by a single family sometimes covers a large part of the surface of a tree, and if the species multiplies round about it, the result of its work is to detach the entire bark, which falls to dust.

The attentive observations of foresters have shown that nearly always a pair of typographers enter the tree together by perforating the bark, and this first task accomplished, they hollow out at this spot a central gallery, which is nothing more or less than a nuptial chamber for the two spouses. Here, resolved to make their lives as agreeable as possible, they pierce for this purpose two to four holes in the bark, which are simply ventilators, intended to air the little chamber, and possibly also to light the windings.

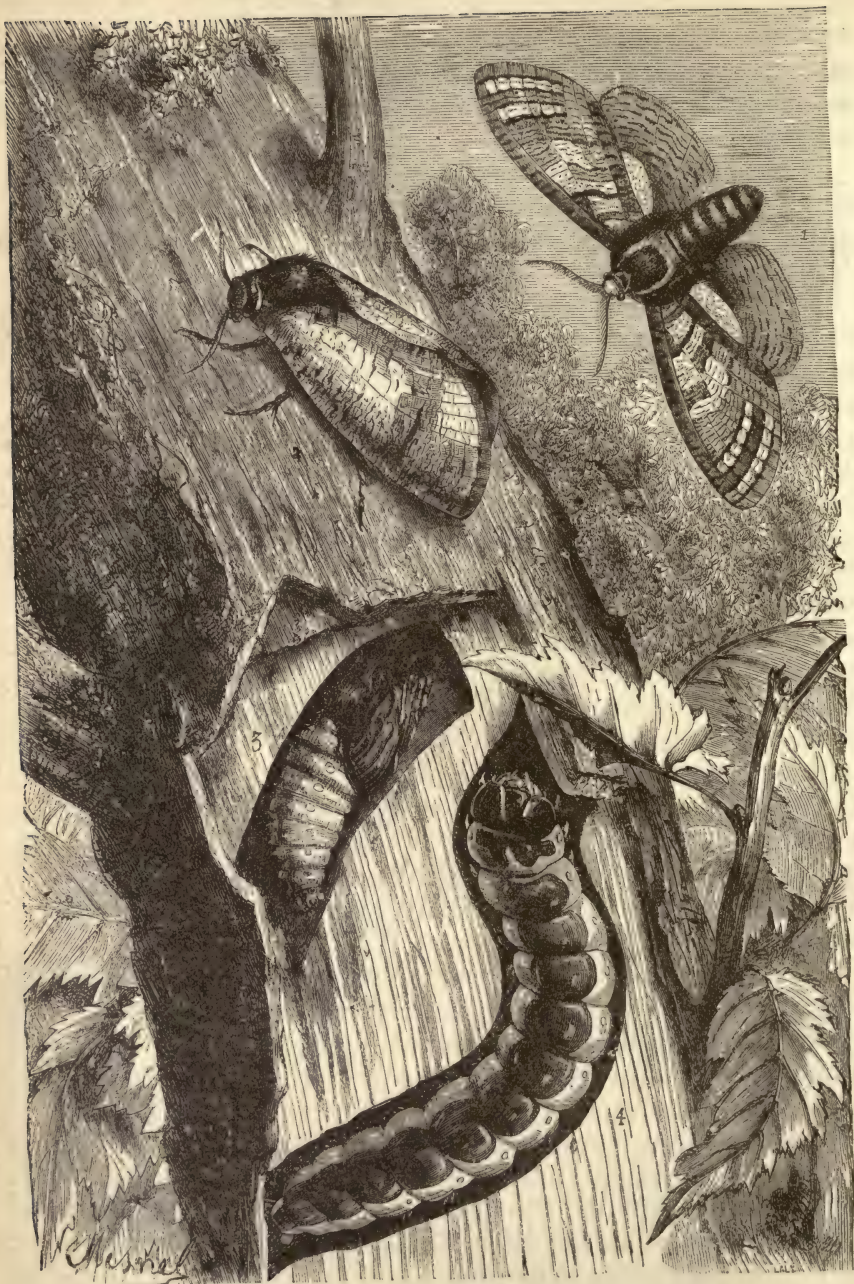
Of all these wood-cutters, the typographer *bostrichus* is regarded as the most dangerous. It ravages the forests of fir-trees in such a manner, that often not a single tree escapes its attacks. It is doubtless in order to give an idea of the extent of its depredations, that naturalists have bestowed on such a little insect the alarming name of the "great pine-gnawer."

Each product has its enemy. Supposing our apples and plums are gnawed and injured by worms, still their soft tissue quite admits of such mischief being done; but fruits so hard and well protected as those of the pines seem as if they ought to be safe from such attacks, though this is certainly not the case.

Insect Carpenters.

The name of joiners is given to those legions of insects which, with their powerful mandibles, cut and divide wood, either to nourish themselves with, or to construct little rooms furnished with partitions, and destined to receive their offspring.

In the first category is found the larva of the goat-moth, a night-moth which sometimes reaches a length of four or five inches, and is thicker



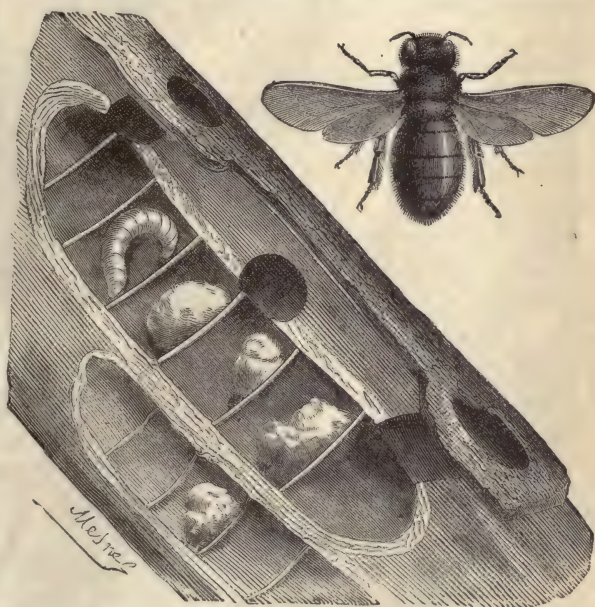
WOOD-BORING GOAT-MOTH.

than the finger. It gnaws the inside of great trees, and scoops out in their trunks large and long tortuous galleries, which sometimes suffice to kill them. We see that it works all the more zealously because its labor is to satisfy a want; it lives on wood.

When several of these powerful caterpillars attack an elm at the same time it sinks very rapidly. This insect has sometimes been seen to utterly destroy large avenues of lofty trees; hence the name of wood-destroying cossus has been given to it.

We find artisans endowed with a very different kind of ingenuity, in a

certain tribe of bees called carpenter-bees, on account of their great skill in working wood. They live principally in tropical countries. One kind, however, inhabits our latitudes; it has the look of a great humble-bee of the most beautiful blue color, and is known by the name of the carpenter-bee. Impelled merely by maternal instinct, its work, which consists of as many little chambers as it lays eggs, is a masterpiece of skill and foresight.



CARPENTER BEE AND ITS LITTLE CHAMBERS.

It is generally beams that this bee attacks. It cuts in them, lengthwise, canals which are a dozen inches deep and more than a third of an inch wide.

When one of these great excavations has attained its entire length, the artisan occupies itself in sheltering its offspring in it. For this purpose it divides the groove into as many little chambers as it is about to deposit eggs. Each of these chambers receives one egg only, and before closing it hermetically the bee stores up a mass of honey and pollen which will suffice for all the wants of the larva that is to be born there. After this the skillful carpenter, by means of finely-rasped wood agglutinated with its saliva, constructs a slender partition which separates each one from

that next to it. In the long excavation which it has hollowed out the insect thus forms a dozen little cellules, which are stuffed with alimentary pap.

When the little creature is born, it finds itself sufficiently restricted as to space, but in proportion as its food diminishes, its movements become more free. The aliment has been wisely proportioned to its wants; the life of the larva terminates at the moment when famine is about to set in. The chrysalis rests imprisoned in its little chamber, but when the fly has thrown off its coverings, air and light are absolutely requisite for it. It then gnaws the partitions which intercept its way, and launches itself into the atmosphere, soon in its turn to commence labors similar to those its mother executed. Such is its destiny.

The Migrating Locust.

The Orient and all the south of Asia as well as the west of the United States are subject to being ravaged by the migratory locust. Their devastations are most extraordinary. Their hosts obscure the sun and every trace of vegetation disappears in their track. Locusts have committed considerable ravages in America; most of the devastation popularly attributed to grasshoppers really belongs to locusts and most often to the red-legged species. They have proved especially destructive to the grass of salt meadows, clover, corn and vegetables, until arrested by the early frosts.

The Rocky Mountain locust is popularly known as the grasshopper. During 1873-74-75 the insect attracted unusual attention and in the unprecedented amount of injury, which it entailed on the farmer of the West, it proved a national calamity. It has been estimated, that \$50,000,000 would not cover the loss occasioned to the country by its ravages during these three years. It is doubtful, whether in their native home the insects show a tendency to migrate, except when forced by necessity. They are sluggish in the cooler parts of the day and fly principally between the hours of 10 A. M. and 4 P. M., and then only, when the wind is in the direction they wish to go. Their life is limited by the spring and autumn frosts and all that hatch in the spring perish at the approach of winter, soon after the eggs are laid.

The grasshoppers travel in immense swarms, not in any particular direction, but in search of food. They walk and hop alternately, moving at the rate of about three yards a minute. As they grow older, their numbers are continually reduced, not only by attacks of enemies and by climatic influences, but by devouring one another.



GREAT SWARM OF MIGRATORY LOCUSTS.

The first day of their appearance their numbers are comparatively few, the second they come by myriads; and yet a day or two might pass before they reached their full number. At early morning the insect, in the pupa state, may be observed issuing from the earth in every direction, by the help of a set of strongly-barbed claws on the fore-legs. Its color is then of a uniform dull brown, and it strongly resembles the perfect insect in form, excepting the absence of wings, ornament, and antennæ. The first impulse of the imperfect insect, on detaching itself from its grave, is to ascend a few inches, or even feet, up the trunk of trees, at the foot of which their holes appear in the greatest number, or upon the rail fences, which are soon thickly spread with them. In these positions they straightway fix themselves firmly by their barbed claws.

Half an hour's observation will then show you the next change which is to be undergone. A split takes place upon the shell, down from the back of the head to the commencement of the rings of the abdomen, and the labor of self-extrication follows. With many a throe and many a strain, you see the tail and hind legs appear through the rent; then the wings extricate themselves painfully from a little case in the outer shell, in which they lay exquisitely folded up, but do not yet unfurl themselves; and lastly, the head, with its antennæ, disengages itself, and you behold before you the new-born insect freed from its prison. The slough is not disengaged, but remains firmly fixed in the fibres of the wood; and the insect, languidly crawling a few inches, remains, as it were, in a daze of wonder and astonishment.

All this passes before the sun has gained his full strength. As the day advances, the colors of the insect become more lively; the wings attain their full strength, and the body dries, and is braced up for its future little life of activity and enjoyment.

The Music Begins.

Between ten and eleven the newly risen tribes begin to tune their instruments; you become conscious of a sound, filling the air far and wide, different from the ordinary ones which may meet your ear. A low distinct hum salutes you, turn where you will. It may be compared to the simmering of an enormous caldron; it swells, imperceptibly changes its character, and becomes fuller and sharper; thousands seem to join, and by an hour after mid-day, the whole country far and wide rings with the unwonted sound. The insects are now seen lodged in or flying about the foliage above; a few hours having been thus sufficient to give them full strength and activity, and bring them into full voice.

The pretty insect, for it is truly such, with its dark body, red eyes, and

its glassy wings interlaced by bright yellow fibres, enjoys but a little week ; and that merry harping which pervades creation from sunrise to sundown, for the time of its continuance, is but of some six days' duration. Like all those of its tribe, the sound produced is not a voice, but a strong vibration of musical chords produced by the action of internal muscles upon a species of lyre or elastic membrane, covered with network, and situated under the wings.

During the whole period of their existence, the closest attention does not detect their eating anything ; and, with the exception of the trifling injury received by the trees, consequent upon the process observed by the female in laying her eggs, they are perfectly innoxious. The end for which they seem to be sent to the upper day is purely confined to the propagation of their species. A few days after their first appearance, the female begins to lay her eggs. When her time comes, she selects one of the outermost twigs of the forest trees or shrubs, and sets to work and makes a series of longitudinal jagged incisions in the tender bark and wood. In each of these she lays a row of tiny eggs, and then goes to work again.

Sudden Resurrection After Seventeen Years.

Having deposited to her hearts's content, she crawls up the twig a few inches yet farther from the termination, and placing herself in a fitting position, makes two or three perpendicular cuts into the very pith. Her duty is now terminated. Both male and female become weak, the former ceases to be tuneful ; the charm of their existence is at an end ; they pine away, become blind, fall to the ground by myriads, and in ten or fifteen days after their first appearance they all perish. Not so, however, their seed. The perforated twigs die, the first wind breaks them from the tree, and scatters them upon the ground. The eggs give birth to a number of smaller grubs, which are thus enabled to attain the mould without injury ; and in it they disappear, digging their way down into the bosom of the earth. Year goes after year, summer after summer, the sun shines in vain to them ; they " bide their time ! " The recollection of their existence begins to fade, a generation passes away : the surface of the country is altered, lands are reclaimed from the forest, streets are laid out and trampled on for years, houses are built, and pavements hide the soil.

Still, though man may almost forget their existence, God does not. What their life is in the long interval none can divine. Traces of them have been found in digging wells and foundations eight and ten feet under the surface. When seventeen years have gone by, the memory of them returns, and they are expected. A cold wet spring may retard their appearance, but never since the attention of man has been di-

rected to them, have they failed ; but at the appointed time, by one common impulse, they rise from the earth, piercing their way through the matted sod, through the hard trampled clay of the pathways, through the gravel, between the joints of the stones and pavements, and into the very cellars of the houses ; like their predecessors, to be a marvel in the land, to sing their blithe song of love and enjoyment under the bright sun, and amidst the verdant landscape ; like them, to fulfil the brief duties of their species, and close their mysterious existence by death.

The Ephemera.

Linnæus has given this name to a genus of insects of the order of neutrophera, from their appearing in the winged state only for a day. The body is long, slender and soft, the wings are very unequal, and the abdomen has long articulated appendages. They are usually called May flies. The mouth of this insect has no jaws, but is furnished with four very short thread-shaped feelers. The wings are erect, the lower ones much the shorter, and the tail is terminated by long hairs or bristles. They differ in many respects from all other insects.

Their larvæ live in water for three years, the time they consume in preparing for their change, which is performed in a few moments. The larva, when ready to quit that state, rises to the surface of the water and instantaneously freeing itself from its skin becomes a chrysalis. This chrysalis is furnished with wings. It flies to the nearest tree or wall, and there quits a second skin and becomes a perfect ephemera. In this state all the species live but a very short time, some of them scarcely half an hour, having no other business to perform than that of continuing the race.

A Creature Born and Dying without Seeing the Sun.

But few of them ever see the light of sun, being produced after sunset during the short nights of summer and dying long before the dawn. The females aided by the threads of their tails and the flapping of their wings, support themselves on the surface of the water and in an almost upright position drop their eggs (sometimes 700 or 800) in little clusters into the water. These insects are remarkable for their elegant flight ; they are continually rising and falling. When they move their wings they rise ; but if their wings, though spread out, remain motionless, as also the silky hairs which form their tail, they fall again. They may be seen in myriads in places where there is much water.

We have said that the ephemera live only for a few hours. This is the general rule ; but their existence can be prolonged for ten or fifteen days by preventing their copulation. If, however, the duration of the life of



EPHEMERA OR CREATURES OF A DAY.

these insects is so short when they have reached the perfect state, and when the conformation of the mouth prevents them from taking any nourishment, their larvæ state is of very long continuance. Swammerdam in his curious Memoir, entitled "*Vita Ephemeræ*," is authority for the statement that it is not less than three years.

The Bee.

The bee is probably of Asiatic origin, whence it has spread over Europe, has been introduced in America and is found in nearly all the warmer portions of the world. It has two stomachs, the first is a large membranous bag, pointed in front for the reception and retention of the honey; no digestion takes place in this, the analogue of the crop or birds. Digestion is performed in the second stomach, which is of a lengthened cylindrical shape, communicating with the first stomach and with the intestine by a projecting valvular apparatus. The muscular strength of the bee is very great and their flight is rapid. A hive of bees consists of three kinds, females, males and workers. The females are called queens, not more than one of which can live in the same hive. Her presence is necessary for its establishment and maintenance.

The males are called drones, and may exist by hundreds and even thousands in a hive. The workers are by far the most numerous. The queen lays the eggs, from which the race is perpetuated; the males do no work and are of no use except to reproduce their species, after which they soon die or are killed; the workers collect the honey, secrete the wax, build the cells and protect the young. The females and workers have a sting at the end of the abdomen, but not the males. This weapon consists of an extensile sheath enclosing two needle-shaped darts of great fineness, placed side by side. Toward the end the sting is armed with minute teeth, like those of a saw, whence it happens that the animal is frequently unable to withdraw the sting from an enemy that it has pierced, causing its own death. When the sting enters the flesh the acrid poison is squeezed into the wound from a bag near its base.

Proper Respect for the Queen.

The poison is a transparent fluid with a sweetish and afterward acrid taste and acrid reaction. The queens are more peaceable and less disposed to sting, than the workers. This is the largest and is easily recognized by the slowness of her march, by her size and by the respect and attention paid to her. She lives in the interior of the hive and only leaves it to lead out a new swarm. If she be removed from the hive, the whole swarm will follow her.



DENSE SWARM OF BEES.

The workers in July and August commence an indiscriminate attack upon the drones, chasing them into the bottom and corners of the hive, killing them with their stings, and casting out the dead bodies. This destruction extends even to the eggs and larva of males. The workers are females, in which the generative organs are not developed. They are divided into nurses and wax workers; the former are the smallest and the weakest, ill adapted for carrying burdens, and their business is to collect the honey, feed and take care of the grubs, complete the cells commenced by the others, and to keep the hive clean; the others provision the hive, collect honey, secrete and prepare wax, construct the cells, defend the hive from attack, attend to the wants of the queen, and carry on all the hostilities of the community.

On the loss of the queen the hive is thrown into the greatest confusion. The food of bees consists principally of the honeyed fluids and the pollen of flowers. The formation of wax is the office of the wax workers. The quantity of wax secreted depends on the consumption of honey.

When a hive becomes too crowded preparations are made for the emigration of a swarm with a queen; scouts are sent out in advance to select a proper place for the new hive, and the workers collect an extra quantity of provisions to be carried with them. During the preparations a great buzzing is heard, which ceases on the day of departure. When all is ready, the signal is given by the workers, and the queen, with all the departing swarm, rushes to the door and rises into the air. They follow the queen, alighting with her in a dense cluster, and returning to the hive if she does. After a rest at their first landing place the swarm collects into a close phalanx and flies in a direct line to the selected spot. Two or three swarms will be sent off in a summer from an old hive.

CHAPTER XXI.

CURIOSITIES OF THE VEGETABLE KINGDOM.

Living Seed in the Earth—The Tap-Root—Plants that Perspire—Catching Water from Trees—Garden Sun-Flower—An Old Physician Living in a Pair of Scales—Vegetable Marvel—The Weeping Tree—Plant with a Movable Lid—Water Treasured in Plants in the Burning Desert—Leaves that Flash Lightning—The Famous Cow-Tree—Vegetable Milk—Butter Tree—Poisonous Compounds—"Herculean Remedy"—India-Rubber Tree—Golden Wealth for the World—Vegetable Giants—Astonishing Magnitudes—Eighteen Guests Taking Supper in a Hollow Tree—Enormous Lime-Tree—Normandy Oak Turned into a Church—Riding on Horseback Through Tree-Cavities—Colossal Baobab—Strange Burial Place—Gigantic Cedars of California—Tops Five Hundred Feet in the Air—Giving a Ball on a Stump—Vegetable Longevity—Methuselahs of the Forest—Historic Lime at Fribourg—Old Age of the Fir—Army of Cortez under one Tree—Legends of Teneriffe—Dragon's-Blood Tree—Where we get Camphor—"Serpents of the Vegetable Kingdom"—Deadly Nettles—The Fatal Upas—Astounding Stories—Antidotes to Poison—Medicinal Treasures—Famous Tartarian Lamb—Part Plant and Part Animal—Wonderful Rafflesia—Plants without Leaves Borrowing those of their Neighbors—Picturesque Scene in the Tropics—Giant Ferns—Mangrove Tree—Sea of Fire—Seeds Sprouting in Human Noses and Stomachs—Marvelous Enginery—Balloon Puff-Ball.



COMMIT a seed to the earth; plant, for example, a haricot bean at the depth of two inches in moist vegetable soil, and if the temperature is right the seed will not be slow to germinate, first swelling, and then bursting its outer skin. By this admirable arrangement, of which nature permits us to contemplate the wonderful results, but without as yet enabling us to comprehend the strange mystery, a plant in miniature, eventually the counterpart of its parent, will, after a time, reveal itself to the observer. In the meantime, two parts, very distinct, make their appearance: one, yellowish in color, usually branched, sinks into the soil—this is the root; the other, of a pale, greenish color, takes the opposite direction, ascends to the surface, and rises above the ground—this is the stem.

The design of the Creator of the world seems to have been to embellish and make beautiful all which was to be exposed to our eyes, while that which was to be hidden was left destitute of grace or beauty. Leaves suspended from their branches balance themselves gracefully with every movement of the air; the stems, branches, and flowers are the ornament of the landscape, and satisfy the eye with their beauty;

but the root is without colors or brilliancy, and is usually of a dull uniform brown, yet performs in obscurity functions as important as those of stem, branches, leaves, or flowers. Yet how vast the difference between the verdant top of a tree, which rises graceful and elegant into mid air—not to speak of the flowers it bears—and the coarse mass of its roots, divided into tortuous branches without harmony, without symmetry, and forming a tangled, disordered mass! These organs, so little favored in their appearance, have, however, very important functions in the order of vegetable action.

All plants which germinate with two seed leaves have, at first, a single descending root, the tap-root. From this central tap-root, lateral roots branch out more or less regularly, and these lateral roots subdivide again and again. In many cases, especially at first, the lateral roots issue from the tap-root with great order and regularity, as much as in the arrangement of the branches of a young fir-tree; in older plants this order is lost. The tap-root is conspicuous in the dock and in seedling fruit-trees; its upper portion in many cultivated plants, such as the beet and carrot, expands under cultivation, and becomes abnormally fleshy.

But all roots are not planted in the soil. There are some plants which develop roots in water, as the duckweed which never touches the earth. Others nourish themselves on the tissues of other plants, as the mistletoe, a singular parasitic plant, which forms tufts or branches of a delicate pale green, attaching itself to apple-trees, poplars, and a number of other trees. Some roots appear, moreover, to have no other function than to fix the plants to the soil; they seem to contribute nothing to their nourishment.

Living on Air.

In the Museum of Natural History of Paris there has been for some years a magnificent Peruvian cactus, of an extraordinary height, which has been growing vigorously, throwing out enormous branches with great rapidity. Its roots are shut up in a box three feet square, filled with earth, which has never been renewed and never watered. It is therefore evident that in this case the roots have little to do with the nourishment of the plant. Other instances confirm these inferences. "In a country where many months pass without a drop of rain falling," says Hilaire, "I have seen, during the dry season, cactuses covered with flowers, maintaining themselves on the burning rocks by the aid of a few weak slender roots, which sink into the dried-up humus which has found its way into the narrow clefts of the rock." Nevertheless, most plants are nourished, to a large extent, through their roots.

Vegetable physiology approaches very nearly that of animals. Like them plants exhale moisture abundantly by their whole surface. It is this which, condensed upon the leaves by the cold of night, forms on them limpid little drops of water, which the vulgar incorrectly ascribe to a deposit of atmospheric moisture.

The idea that plants transpire like animals is due to Muschenbroeck, one of the professors who have contributed most to rendering the university of Leyden illustrious. For this purpose he covered with a plate of lead the whole circumference of the root of a white poppy, so as to prevent the vapor of the earth from interfering with his experiment. The plant was then covered with a bell-glass cemented to the lead. After that each morning when the naturalist came to visit the imprisoned plant he observed, that even during the driest nights its leaves were covered with an innumerable quantity of those drops of water to which the name of dew is given, and that the sides of the glass themselves were quite obscured with it. It is not then from the air that the dew of the meadow and the leaf comes, but, as the Dutch naturalist learned, from the sweating of the plant; dew is only their perspiration condensed.

Plants that Rain.

This fact being thoroughly established, it only remained to decide the amount which vegetable transpiration produces. Mariotte tried a very elementary experiment on this head. Having cut off a branch and covered the section with impermeable cement, he observed that the leaves, while withering, had lost two tea-spoonfuls of water in two hours, at a time when the air was tolerably warm. The naturalist therefore concluded that in twelve hours the branch would lose a dozen tea-spoonfuls.

But such an estimate was far from being exact. Guettard managed better; he conceived the idea of not separating the branch from the plant, but of enclosing it in a globe of glass, terminating outwardly in a neck which was inserted into a flask. When all was hermetically sealed, the moisture transpired, condensing itself little by little on the sides of the globe, fell drop by drop into the bottle situated beneath it, and could be collected without the slightest loss, so that nature was left to herself.

When on a burning summer day, exhausted and streaming with perspiration, we see in the by-nook of a parterre the garden sun-flower, we admire its heavy floral crown turned towards the luminary which it ceaselessly accompanies in its course, and its ample and motionless leaves; but this apparent calm veils a most unexpected vital energy.

Who indeed would think that the perspiration exhaled by the leaves of the plant is more copious than that which moistens our foreheads? Yet

science has proved this ; after demonstrating the existence of vegetable transpiration, it has dared to estimate comparatively the product of it.

An old physician of Padua, Sanctorius, whose originality has become celebrated, had the patience to pass a great part of his life in a pair of scales, weighing and re-weighing himself every minute in the day, in order to ascertain how much loss his body underwent by transpiration.

Hales, without having the same perseverance, attempted to ascertain what weight of water a sun-flower lost daily by its leaves. For this purpose he put one of these plants into a pot, the upper surface of which, hermetically closed with a plate of lead, only presented one small neck through which it could be watered. By weighing this sun-flower daily his scales showed him that it lost, by the transpiration of its leaves only, twenty ounces of water in the twenty-four hours, being seventeen times as great as our own.

But the vegetable marvel in respect to transpiration is the weeping-tree, which was seen some years ago in one of the Canary Islands. The water fell like copious rain from its tufted foliage. Collected at the foot of the tree, it formed a kind of pond, from which the inhabitants of the vicinity furnished themselves with water.

Weeping Tree.

At first, says a naturalist, I suspected some exaggeration in the accounts given by travellers as to the transpiration of this tree, but after seeing an arborescent fuchsia in one of the green-houses of the botanical garden of Rouen rain down so much water upon the plants round about it that it was necessary to remove them, I have believed their statements.

The insensible transpiration is demonstrated by the most simple experiment. It is only necessary to place a plant under a dry bell-glass, the base of which is plunged in mercury. In a few seconds all the inner surface of the glass is covered with tiny drops of water, which become condensed and run downwards.

In the "History of the Canary Islands," by Galindo, it is stated that there was at Ferro a laurel-tree which, according to Roulin, furnished the natives of the island with drinking water. This fluid distilled drop by drop from the foliage, and was preserved in cisterns. This marvelous vegetable fountain was, during part of the day, enveloped in a cloud, from the bosom of which it drew its supply of water. But the tradition of the tree quoted by the old historian of the seventeenth century is no longer found among the conquerors of the island.

The leaves of other plants, more tenacious of the perspiration they distil, collect it in little cups, which are found at their ends, sometimes

THE FAMOUS WEeping TREE.



constantly open, sometimes closing and opening by means of a movable lid.

In the first rank we ought to place the famous pitcher plant. Its leaves display a strong mid-rib, which extends beyond the blade and ends in an elegant cylindrical cup, provided with a hinged lid, which spontaneously opens and closes according to the state of the atmosphere. During the night this lid sinks down and hermetically closes the little vase, which then fills with limpid water exhaled by its walls. During the day the lid is raised and the fluid evaporates more or less completely. The beneficent *nepenthe* has often quenched the thirst of the Indian lost in his burning deserts.

In the marshy forests of Southern America Providence has intrusted this task to another distilling plant, the purple *sarracenia*, the structure of which is no less eccentric. Its leaves, uniting at their edges, are transformed into elegant cups, the narrow opening of which is surmounted by an ample green auricle decorated with scarlet red veins, to which the species owes its name. These cups, presents from the empire of flora, and which rise from spot to spot at the feet of the traveller, are filled with pure and delicious water, for the benefit of which he is all the more grateful, as he is encircled by nothing but marshes, the water of which is lukewarm and nauseous.

Some plants, instead of distilling their resinous products drop by drop, form a gaseous vapor, and this clings so close around the plant, that if, during the twilight of a still, burning hot summer day, we approach it with a lighted candle, the vapor takes fire, and produces a bright light which envelops all the foliage, sparkling like the substances burned in the theatres on the torches of the furies. This can be seen in the *fraxinella* cultivated in our gardens. Should the atmosphere be less tranquil, the experiment is easily made by surrounding the plant with a glass case. So soon as an ignited body is plunged into it, a general combustion ensues.

Plants that Flash Lightning.

Other plants, during darkness, project inexplicable gleams of light. This extraordinary phenomenon, which is attributed to electricity, was first pointed out by Mademoiselle Linnæus, and afterwards recognized by some naturalists.

When speaking of vegetable secretions, we cannot, in the present day, omit a beautiful tree of the family of *sapotaceæ*, formerly considered useless, but which furnishes us with one of the most precious substances—gutta-percha. Spread over the coasts of Sumatra and Java, its produce has only been advantageously worked during the last twenty years. Like



WORLD-RENOVED INDIA-RUBBER TREE.

the gold of California, this tree has caused great social changes in the countries where it grows.

A Tree that Gives Milk.

In Caracas, in South America, grows the cow-tree, which, when its trunk is wounded, furnishes an abundant supply of milk, of which the traveller can confidently drink freely, for it unites all the qualities of the milk of our domestic animal, which it entirely replaces in some countries of America. We take the following extract from the journal of a traveller in South America: Supplied with vessels, we went on a few yards further, when we stopped under an enormous tree, one of the giants of the forest. Its trunk was covered with deeply scored reddish and rugged bark. A native patted it, saying, "This my cow." Another tree of the same species, but much smaller, grew near. He ran to it, and saying, "Small cow give better milk," began to attack it with his axe. After making a few strokes, out flowed a perfectly white liquid, which was caught in the monkey-cup. The milk continued to flow in great abundance, so that we soon had four cups filled full of the tempting liquid. On tasting it we found it sweet, and of a not unpleasant flavor, and wonderfully like milk.

One of the trees which yield our internal economy services as important as the preceding is the butter-tree. It furnishes the negroes of the Niger with a secretion which they substitute for the ingredient used in our kitchens, and with which they prepare all their food. It is sold abundantly in their markets, where it is known as shea-butter.

Nature offers us in profusion the greatest contrasts. On one side, with generous and beneficent hand she lavishes food and salutary remedies; on the other, she only distils poisons, as though in the laboratory of Medea. Here we see opium perspiring like a milky dew from the heads of our poppies, and becoming so indispensable to the art of medicine, that Sydenham, the Hippocrates of modern times, said he would renounce his profession were he deprived of this powerful anodyne. There we behold the poisons of belladonna, datura, and henbane, by turns useful and deadly.

But no tree bears in its invisible laboratories such precious crystals as the cinchona; nature offers us no other medicine which is so potent. The cinchona alone arrests the ravages of deadly fevers in their fatal progress; without it many countries would be uninhabitable, many journeys impossible. Hence, in their enthusiasm about its marvelous power, many physicians, in imitation of Torti, have given it the name of "herculean remedy."

As respects the milk or cow-tree, Humboldt, who analyzed its pro-



EXTRACTING MILK FROM THE COW-TREE.

ducts, states that its physical properties are exactly similar to those of cow's milk, except that it is a little more viscous. It is remarkable for containing an enormous quantity of wax. This substance constitutes the half of its weight, and hence the learned chemist proposed to cultivate the tree in order to extract the wax.

Mysteries of Vegetable Life.

Like animals, plants may be infinitely little or infinitely huge ; the latter astonish us by their colossal proportions, while the former escape our ken and are only revealed by the microscope. The study of the development of plants in respect to their mere size presents us with curious contrasts.

Some rudimentary plants, such as the ascophori, mould fungi which so frequently invade our bread, and the aspergilli which we often see forming glairy repulsive-looking films in the fluids we drink, possess only an almost invisible stalk. Woody plants, on the contrary, often astonish us by the enormous dimensions of these parts. The old authors who describe Germany tell us that there were trees there, from the trunk of one of which boats were made which carried as many as thirty men.

From the times of antiquity the luxuriant growth of the plane-trees on the banks of the Bosphorus and the Black Sea has been the subject of remark, and the botanists of our day have proved that what our forefathers said was in no way exaggerated.

Men were almost inclined to disbelieve the account of Pliny, who states that in his time there was in Lycia a stout thriving plane-tree in the trunk of which was seen a vast grotto eighty-one feet in circumference, the whole extent of which had been tapestried by nature with a green and velvety hanging of moss. Licinius Mutianus, governor of the province, charmed with the delicious coolness of this rural hall, gave a supper in it to eighteen guests from his suite. After the orgy they transformed the scene of their festivity into a dormitory, and comfortably passed the night there.

This fact has been fully confirmed by modern travellers. De Candolle relates that according to one of them, there still exists in the neighborhood of Constantinople an enormous lime-tree, the trunk of which is quite as ample as that of which we have been speaking. It is 150 feet in circumference, and also presents a cavity 80 feet in circuit.

A Tree Transformed into a Church.

The Rev. J. Ray, an English clergyman who wrote a valuable work on botany, speaks of an oak existing in his time in Germany which was of such dimensions that it had been transformed into a citadel. To confine ourselves more strictly to the truth, let us just say that its interior served as a guard-house. We may here mention another tree of the same kind,

GIGANTIC CHAPEL OAK IN NORMANDY.



still growing in Normandy, and which, in contrast to the other, has been consecrated to piety. This is the chapel oak of Allouville, in which there is an altar dedicated to the Virgin, where on certain days mass is said. The ample hollow of this tree not only furnishes an oratory, but above this a sleeping-room has been scooped out; there is a bed in this room to which access is gained by steps outside: it is the abode of an anchorite. This tree, which perhaps sheltered in its shade the companions of the Seigneur de Bethencourt when on their way to embark for the conquest of the Canaries, is held in great veneration in the country.

One of the most illustrious and philosophic botanists, Marquis, renowned alike for his eminent position and knowledge, measured the trunk of this tree, and found that it was thirty feet in circumference near the ground. There may be seen on the banks of the Bosphorus plane-trees the trunks of which were pierced with enormous cavities. In the neighborhood of Smyrna there is one of these trees celebrated for its size and antiquity. The stem which is hollowed right through, is spread widely out at the base, and represents three columns, which converge towards each other, forming a sort of porch beneath which a man on horseback can pass easily.

A Vegetable Goliath.

Yet the baobab on the banks of the Niger, in its splendid luxuriance of growth, surpasses even all the giants of the Bosphorus. It is especially remarkable for its thickness, contrasted with its want of height. It is a colossus of ungraceful look. Occasionally without leaves, bearing them only in the rainy season, its whitish conical trunk, scarcely fifteen to twenty feet in height, is more than a hundred feet in circumference at the level of the ground. This short and robust support is necessary to sustain its incredibly large dome of leaves, the bulk of which is sometimes so great that, seen from a distance, the baobab looks rather like a small forest than a single tree. Its large branches are fifty to sixty feet long. When time has hollowed out the stem of one of these noble trees, the negroes make use of the cavity. Sometimes they turn it into a place of amusement, a rustic retreat where they can smoke their chibouques and take refreshment; at other times they convert it into a prison. One of these is known of which the Senegambians have converted the interior into a council-hall; the entrance is covered with sculptures which point out the high destination reserved for it.

The leaves are of a deep green, and divided into five unequal parts, each of which forms a narrow lanceolate figure, radiating from a common centre, the outermost being smallest. The flowers, which grow

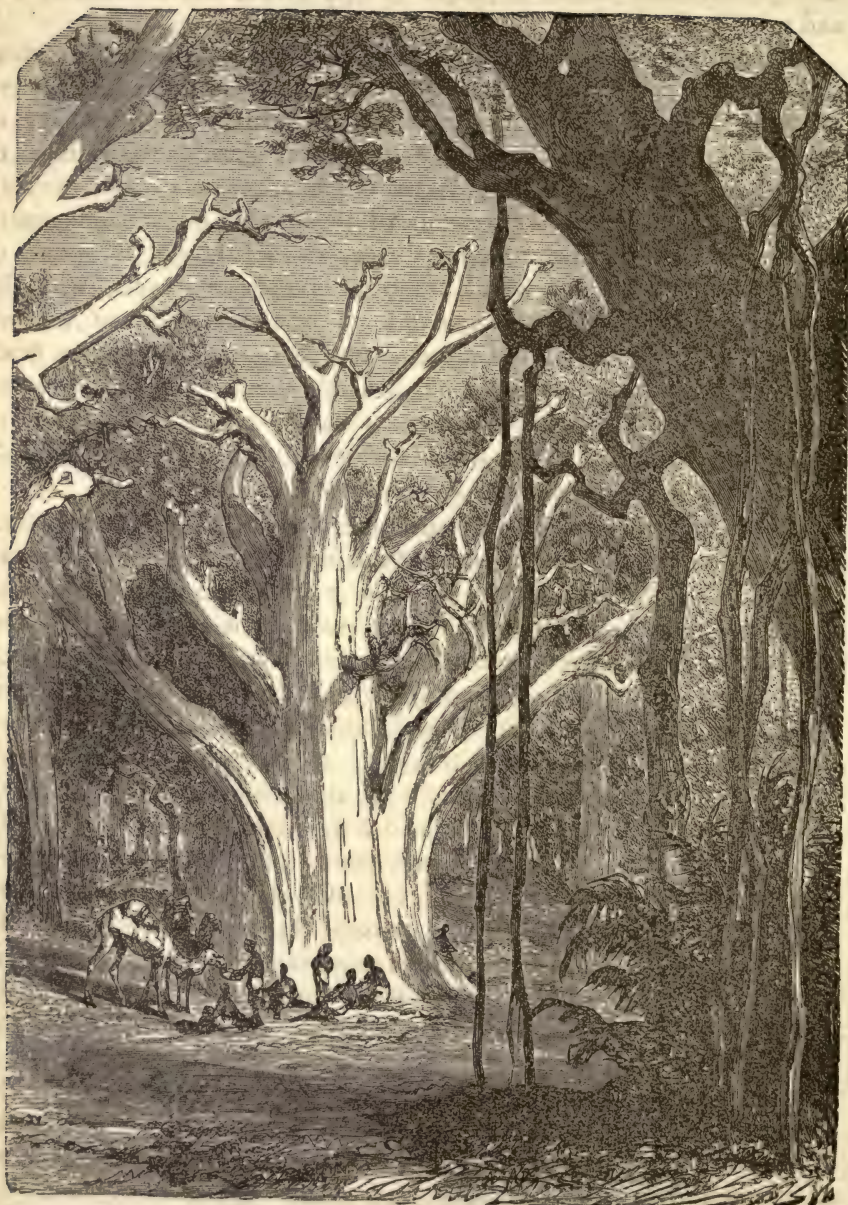
singly in a pendulous position, before the appearance of the leaves, are large and white, crumpled at the edge, the petals being much reflexed; the stamens numerous, and collected into a tube, which spreads at the top into an umbrella-like head, from which rises a slender curved style, terminating in a rayed stigma.

The bark and leaves of this tree possess considerable emollient properties, of which the natives take advantage. The natives make a daily use of the pounded leaves of the baobab, which they call *lalo*, to mix with their food, for the purpose of inducing perspiration. Its flowers are proportioned to the gigantic trunk, their breadth being from five to six inches. The fruit, called by the French settlers on the Senegal monkey bread, is ovoid, pointed at one of its extremities, and from eight to eighteen inches long by six or seven broad. It encloses in its interior from ten to forty cells, containing kidney-shaped seed, surrounded by mucilaginous pulp, which is sweet, and of an agreeable flavor; the juice, when extracted and mixed with sugar, forms a beverage very useful in the putrid and pestilential fevers of the country. The fruit is transported into the eastern and southern parts of Africa; and the Arabs carry it to the countries round Morocco, whence it finds its way into Egypt. The negroes take part of the damaged fruit and the ligneous bark, and burn them for the sake of the ashes, from which they manufacture soap by means of palm oil.

Strange Burial Place.

They make a still more singular use of the trunk of the baobab; they deposit in it the bodies of those among them whom they consider unworthy of the honors of sepulture. They select the trunk of some baobab already attacked and hollowed out by insects or decay; they increase the cavity, and make a kind of chamber, in which they suspend the body. This done, they close up the entrance of this natural tomb with a plank. The body becomes perfectly dry in the interior of this cavity, and becomes a perfect mummy without further preparation. This kind of sepulture is especially reserved for the Guériots; they are the musicians and poets, who preside at all fêtes and dances at the courts of the negro kings.

During their life this kind of talent gives them influence, and makes them respected by other negroes, who look upon and honor them as sorcerers; but after death this respect is succeeded by a kind of horror. These superstitious people imagine that if they consigned the body of one of these sorcerers to the earth, as they would the bodies of other men, they would draw upon themselves the celestial malediction. Hence the monstrous baobab serves as their resting place. It is a strange senti-



COLOSSAL BAOBAB OF THE VIRGIN FORESTS OF AFRICA.
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ment which leads barbarous people to bury their poets between heaven and earth in the heart of this vegetable king.

Yet whatever astonishment we may feel at the extraordinary dimensions attained by the trunks of certain trees, the height to which others reach strikes us still more than their growth in diameter. The king of our forests, the oak, which poetic fiction looks upon as the emblem of passive force, rears its crown of leaves one hundred feet above the soil.

In the East the imposing remains of the ancient forest employed in building the temple of Jerusalem, the cedars of Lebanon, the object of so much veneration, and which the pilgrim only approaches with the sounds of a hymn on his lips, spread forth their dark sheets of verdure at a height of 150 feet above the mountain. Supported only by its flexible column, which yields and bends beneath the force of the tempest, the wax-palm on the Andes balances its waving crown in the bosom of the clouds 200 feet above the heights whereon it grows.

Giants with Heads in the Clouds.

But no tree rears its head towards the sky so boldly as the gigantic cedar of California. One colossus of this species, now hurled down and stretched upon the rock, presented when it stood erect and threatening a height of more than 490 feet, that is to say, about eight times the elevation of a house of five stories. It was above 130 feet in circumference.

The bark of the trunk of one of these giants of our American forests was transported in part to the Crystal Palace at London, where it formed one of the most splendid curiosities, until accidentally destroyed by fire in 1866. It was a monstrous column, above 130 feet in height, and which at the level of the ground had a diameter of nearly thirty-four feet. At San Francisco a piano was placed and a ball given to more than twenty persons on the stump of a cedar which had been brought thither. The age of this colossus corresponds to its dimensions. By counting the number of annual rings in a transverse section, it was ascertained that these monstrous trees must be several thousand years old, so that they seem to have stood erect and unshaken amidst many of the commotions of the globe.

Alongside of these giants stretched prostrate on the ground, man only looks like a pigmy and feels his littleness. He calls them the mammoths of the forest, to show that, like those frightful animals which surpassed all others in their size, they tower above all the vegetable kingdom.

Vegetable Longevity.

But if anything ought to astonish us in the life of trees it is their longevity; we might even go farther, and speak of the principle of eternity

which is clearly latent in some species, the death of which seems rather to depend upon fortuitous circumstances than on the fact of age. The life of animals is quite ephemeral compared to that of our trees. Minute investigations have thrown considerable light upon the chronology of many of them. Some of them live commonly 200 or 300 years.

The pine and great chestnut can assuredly extend their existence to a term of 400 or 500 years. In the island of Teneriffe are found many venerable pines and enormous chestnut-trees, which, in all probability, were planted there by the Conquistadores at the commencement of the fifteenth century, the epoch of the invasion of this island. The former are distinguishable from the others, owing to the conquerors having in their piety decorated them nearly all with little madonnas, which are still seen suspended to their boughs.

The lime-tree of Morat, planted at Fribourg on the day of the celebrated battle, is one of the oldest trees in Europe. This glorious event in the history of Switzerland, having occurred in the year 1476, the venerated tree, which is encircled by a colonnade, and of which the aged branches are upheld by a framework of wood, must be now more than 400 years old.

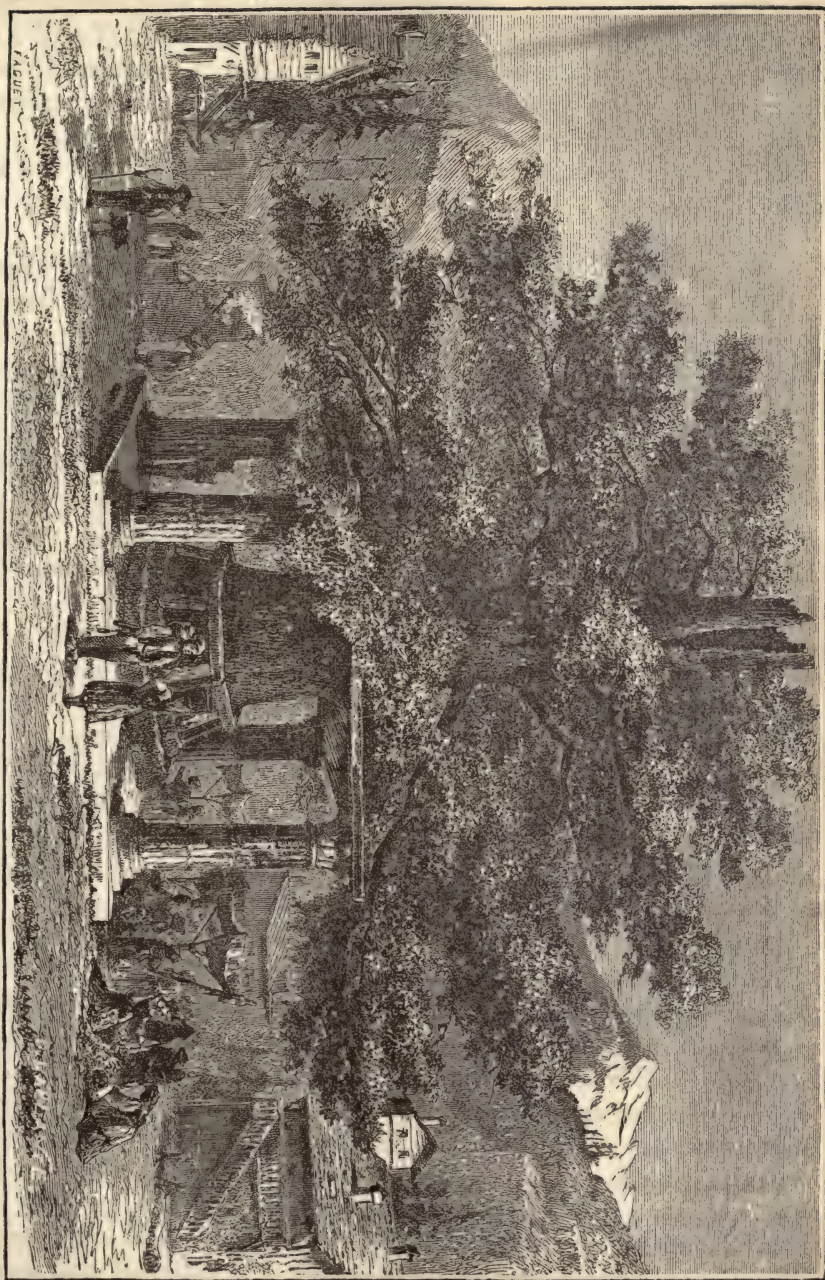
The fir attains a still greater age. In some of the most ancient forests of Germany, situated on mountain summits, as many as 700 annual layers have been counted on some of the trees cut down there.

The olive-tree, so revered in ancient Greece, and which inspired such beautiful verses in the tragedy of *Ædipus* by Sophocles, reached a much greater age, according to the ancient myth. Pliny even asserts that in his time the celebrated olive-tree which Minerva caused to spring from the ground at the epoch of the foundation of the city of Cecrops was still to be seen in the citadel of Athens.

Sheltering an Army.

An immense tree on the road from Vera Cruz to Mexico is celebrated for having sheltered the whole army of Fernando Cortez beneath its mighty shade. Its birth, according to some botanists, seems to date from an epoch so remote as to be almost beyond our ken. As its trunk, which is 117 feet in circumference, surpasses that of the baobabs, and as its growth is slower than theirs, De Candolle supposes this tree may be several thousand years old. The army of Cortez was composed of six hundred Spanish foot-soldiers, forty horsemen, and nine small pieces of artillery.

Meanwhile we ought not to be astonished at seeing some botanists look upon trees as so many beings, the life of which is unlimited, and many of which, born amid the debris of former cataclysms, still vegetate full of sap



HISTORIC LIME TREE OF THE BATTLE OF MORAT.

and vigor. De Candolle, who puts forward this opinion, considers the giants of our forests as so many aggregates of individuals, or buds, annually succeeding on the stem, which thus represents a living soul. This stem grows on, century after century, and only succumbs by accident, as when struck by lightning, or when its suckers cannot find nutritive juices. Thus then, we repeat, actual science demonstrates what antiquity had only dimly seen.



DRAGON'S-BLOOD TREE OF THE ISLAND OF TENERIFFE.

The slow development of the trunks of certain trees at once calls up images of immobility and eternity. The dragon's blood tree of the Canaries awakens such thoughts. Thrice famous for its strange look, its vast size, and its antiquity, this dragon's-blood tree is equally so for the stationary condition of its growth. In the legends of Teneriffe we are told that this singular tree was worshipped by the Guanches, its original inhabit-

ants; and it is related that in the fifteenth century mass was celebrated in the interior of its trunk, a fact even lately attested by the vestiges which were seen of a little altar. This tree grows so slowly that after a tolerably long interval of time it was not possible to verify any change in its circumference.

It was accurately measured in 1402 by the companions of Bethencourt at the time when they discovered the island, that is to say, more than 485 years ago, and since then it has in no way increased in diameter. Time has passed over without touching it. Humboldt, when he ascended the peak of Teneriffe in 1799, measured this tree a little above the level of the ground, and found it forty-five feet in circumference.

Where Camphor Comes From.

Whilst the cinchonas and the cinnamon conceal their active juices in the thickness of the bark, other trees, such as the camphor laurel, spread them through all their organs—stems, roots, and leaves. These trees, covered with brilliant glazed leaves of bright green, ornament the regions of India and Java. The camphor which they furnish is extracted in the easiest manner: all the natives have to do is to break up the tree into small pieces, and heat these in water, when the precious essence condenses on the lid of the retort.

The seeds of some plants are used by the Chinese as soap. Sowerby has suggested that the leaves of the soapwort might be used for the purpose, as they undoubtedly were in by-gone times, especially it is said by the mendicant friars. The lather formed by boiling or bruising the seeds in water has all the effect of soap, and readily removes grease, so that we here find nature spontaneously developing a great manufacturing product, which under man's hands has taken two thousand years to bring to its present perfection.

Beneath the burning sun of India, where the naja distils its dreadful venom, the nettles secrete a mortal poison. This analogy to the reptile is doubly exact, so that we are not at all astonished to see a German botanist call the urticæ "the serpents of the vegetable kingdom." It is in fact by the same kind of organ that the plants introduce the venom into a wound; and if we look at the minute quantity with which one of their hairs inoculates us, not perhaps the hundred and fifty thousandth part of a grain!—at the rapidity and intensity of the symptoms—it is clear that the poison of the nettle is the deadliest known.

Our indigenous species only produce a burning sensation, which is soon dissipated, but those of tropical countries give rise to very serious results. Leschenault says that he has seen the sting of the indented

nettle bring on the most horrible suffering for a whole week. Another species, which grows at Timor, and which the natives call the devil's leaf, produces such serious wounds, that, according to Schleiden, amputation is the sole means of saving life.

The Fatal Upas.

In the midst of this fearful cohort of deadly plants, the upas-tree of Java stands prominently out as one of those which distil the most terrible juices. Its action is such that a weapon dipped in it at once kills any animal it strikes. Travellers relate having seen several criminals die in six minutes after being pricked below the bosom with a lancet dipped in the juice of this tree.

No tree has been the subject of so many ridiculous fables as the upas, and till quite lately they were popularly believed. On the faith of a Dutch surgeon it was related that the upas flowed from a unique and singular tree, which vegetated in the midst of a frightful solitude in Java, "the valley of death." According to this traveller, no living creature could resist the poisonous vapors which it exhaled, and for three or four leagues around only dead bodies and skeletons of men and animals were to be met with. The birds themselves which ventured into the surrounding air fell to the ground as if struck by lightning. Criminals condemned to capital punishment alone essayed the task of wresting its infernal produce from the tree. Many tried the perilous journey, but very few returned from it.

It is disgraceful to be obliged to admit, that we owe the refutation of this fabulous narrative to so recent a writer as Leschenault. This traveller noticed that the famous poison is furnished by two species of trees which grow amid the forests of Java. So far from exercising a deleterious influence upon all that surrounds them, they are encompassed by a luxurious vegetation, while birds, lizards, and insects lend animation to their boughs and foliage. The learned Frenchman, while examining one of these trees which he had had cut down, had his face and hands covered with exudation flowing from the broken branches, yet he experienced no bad effects from this circumstance.

But it is very different when the juice of the upas is introduced into the organism by means of the smallest puncture. A wound of this kind destroys a dog in five or six minutes, as Magendie noticed in his experiments. Eight drops of the juice injected into the veins of a horse kill it directly.

Medicine Stored up in the Vegetable Kingdom.

Other plants, more happily gifted, instead of these deadly poisons, elaborate at the same time medicinal agents and nutritive matters. One



POISONOUS TREE OR UPAS OF JAVA.

of these products furnishes a remedy in sickness, another increases the luxury of our tables. This is the case with the rhubarbs. Their large roots are quite full of purgative and strengthening principles, whilst their leaves display strong stalks which serve for food. In our country an enormous quantity is consumed in the spring for pastry and side-dishes, and at this time of the year trains of vehicles heavily laden with rhubarb leaves are seen arriving at our markets.

For long a kind of sympathy between certain plants has been observed to exist, as if one loved to be under the shade of the other. Thus on the banks of our rivulets the amaranth-colored flowers of the purple loosestrife constantly adorn the vicinity of the willow. Other plants, on the contrary, seem to experience an aversion one for the other, and if man inconsiderately compels them to approach each other, they languish or die. The flax plant, for instance, seems to have a manifest antipathy for the scabious. At the present time these peculiarities are explained by assuming that the roots emit products favorable to certain species and hurtful to others.

Marvelous Eastern Story.

Among the strange stories to be found in the narratives of the early travellers, few are more strange than that of the vegetable lamb of Tartary. This story, as believed by the reading public, and even by the naturalists of two centuries ago, is so marvelous, and so obviously absurd, that the greatest wonder is that it ever could have been thought to be true, even by the most credulous in a dark age.

It was believed that in an elevated and uncultivated salt-plain of great extent, west of the river Volga, there was to be found a wonderful creature, half animal and half plant, to which the natives gave the name of barometz, meaning little lamb. Struys informs us that the Tartars and Muscovites esteem it very much, and the greater part preserve it with great care in their dwellings, where he had seen many of them.

To obtain it the Tartars sow in the ground a seed like that of a melon, from which in due time rises the strange plant, having the figure of a lamb, with the feet, hoofs, ears, and the whole head, except the horns, of that animal, distinctly formed. It grows on a stalk about three feet in height, being, according to one version, rooted to the ground by its four feet, while another account raises the whole lamb, feet and all, from the ground on a single stem, on which it is able to turn, and also to bow itself downwards to the herbs on which it feeds. It lives as long as there is grass and herbage around it, but when it has consumed all within its reach it dies and withers away. Its skin is covered with a very white

down, as fine as silk, and is greatly prized by the Tartars, who pull it off, and wear it as a cover for the head. Inside it is composed of flesh and bones, and when wounded it gives out a liquid resembling blood. Wolves are said to be the only animals that will eat it, and they are very fond of it.



UNIQUE TARTARIAN LAMB.

Specimens of this remarkable production were looked upon as the rarest treasures in the collections of the curious in days gone by. Two different specimens have been described in the "Philosophical Transactions," and a third has its portrait given in an engraving in Mr.

Darwin's "Flower Garden," and its history told in the florid verse of that work. These various figures have been introduced by the artist into the accompanying illustration, which not only gives the old fable, but its modern interpretation as well.

The "lamb" is a natural production, greatly helped in the development of the particulars in which it most resembles that creature by the ingenuity of the natives. The body is a portion of the creeping stem of a tribe of ferns, which generally grow as erect as trees. This stem is densely covered with beautiful jointed silky hairs of a rich golden color. On the surface next the ground a few roots are given off, while the leaves—or fronds, as they are called in ferns—spring from the upper surface. The fronds are as much as twelve or fourteen feet high, and have a long bare stalk before the leaf is spread out. The Tartar takes a suitable portion of this creeping stem for a body, deprives it of the roots, and of all the leaf stalks except four, which are intended to be the legs, two short ones for the ears, and a stump for the tail, and then turning it upside-down, trims the stem, and so produces this marvel of the early explorers. The fern is a native of Eastern Asia; it has been introduced into our conservatories, where it flourishes, producing, after a few years' growth, good specimens of the "lamb."

The silky hairs of this fern form a favorite remedy among the Chinese for checking the flow of blood by applying them to a wound, in the same way as felt or cobwebs are used by some people in this country. The more fibrous and elastic hairs of several species of the same group, natives of the Sandwich Islands, are largely exported from these islands to California and Australia for stuffing cushions, and similar purposes.

The Rafflesia.

"Come with me, sir; come! A flower, very large, beautiful, wonderful!" exclaimed a Malay, who drew the attention of Dr. Arnold to a flower, remarkable alike for its enormous size and its anomalous structure and habit. And the surprise of the Malay was nothing compared with that of Dr. Arnold and his companions, Sir Stamford and Lady Raffles, when, following their native attendant, they saw among the bushes of a jungle a flower apparently springing out of the ground, without stem or leaf, and measuring at least a yard in diameter. The first news of this remarkable discovery created a great amount of curiosity in Europe, and no papers ever read at the Linnæan Society can be compared, for the interest they excited, with those in which the illustrious Robert Brown described this wonder of the vegetable world.

Sir Stamford Raffles having been appointed governor of a settlement in

Sumatra, and impelled by his great love for nature, resolved to explore that little-known island. On his first journey, in 1818, he took with him Dr. Arnold, an ardent and promising naturalist, who died as a new world was opening before him. He, however, discovered this gigantic flower;

NATIVE FOREST IN SUMATRA WITH ELEGANT SPECIMENS OF RAFFLESIA.



his drawings and descriptions were left unfinished, but his patron carefully preserved and perfected them, and Robert Brown perpetuated the memory of both in connection with the plant, by naming it *Rafflesia Arnoldi*.

The most striking feature in the *Rafflesia* is its enormous size; indeed, it is the largest and most magnificent flower in the world. It is composed

of five roundish leaves or petals, each a foot across, of a brick red color, but covered with numerous irregular yellowish white swellings. The petals surround a large cup nearly a foot wide, the margin of which bears the stamens; and this cup is filled with a fleshy disk, the upper surface of which is everywhere covered with curved projections, like miniature cow's horns. The cup, when freed from its contents, would hold about twelve pints of water. The flower weighs fifteen pounds. It is very thick; the petals being from one to three-quarters of an inch.

Gorgeous Flower with Repulsive Odor.

A flower of such dimensions and weight might be expected to be a treasure to the perfumer; but, alas, its odor is exactly that of tainted beef! Dr. Arnold supposed that even the flies which swarmed over the flower when he discovered it were deceived by its smell, and were depositing their eggs in the thick disk, taking it for a piece of carrion!

Another cause of wonder to the little band of explorers who discovered it, was that they could find no leaves connected with it. It sprang from a small, leafless creeping stem, about as thick as two fingers. Now a plant without leaves is like an animal without a stomach; for the leaves are to the plant what the stomach is to the animal; they separate from the air the food needed for the growth of the plant. Without them there could be no wood, no bowers, no fruit, no seed. Plants, therefore, have leaves—some consist of only a leafy expansion, and even the single cells of minute and microscopical plants are really leaves reduced to their simplest structure.

There are, however, strange plants which are actually leafless, making up for this want by using the leaves of others. Such plants are called parasites, because they feed on the nutritive juices of others. Thrusting their roots into the living tissues of other plants instead of into the earth, they appropriate the prepared food of these plants, and at once apply it to their own purposes for the production of stem, or flower, or fruit. The most familiar example of such a parasite is, perhaps, the dodder, one kind of which infests cultivated flax, while others are found on clover, heath, and whin. The gigantic *Rafflesia* belongs to this class. Without a vestige of foliage, it rises at once from the long slender stems of one of the wild vines of Sumatra—immense climbers, which are attached like cables to the largest trees in the forest.

The buds push through the bark like little buttons, continuing to grow until they have the aspect of large closed cabbages, and in about three months after their first appearance, the flower expands. It remains but a short time in perfection, soon beginning to rot, leaving only

the central disk, which becomes a large, rough fruit, filled with multitudes of small, simple seeds.

Brilliant Tropical Scene.

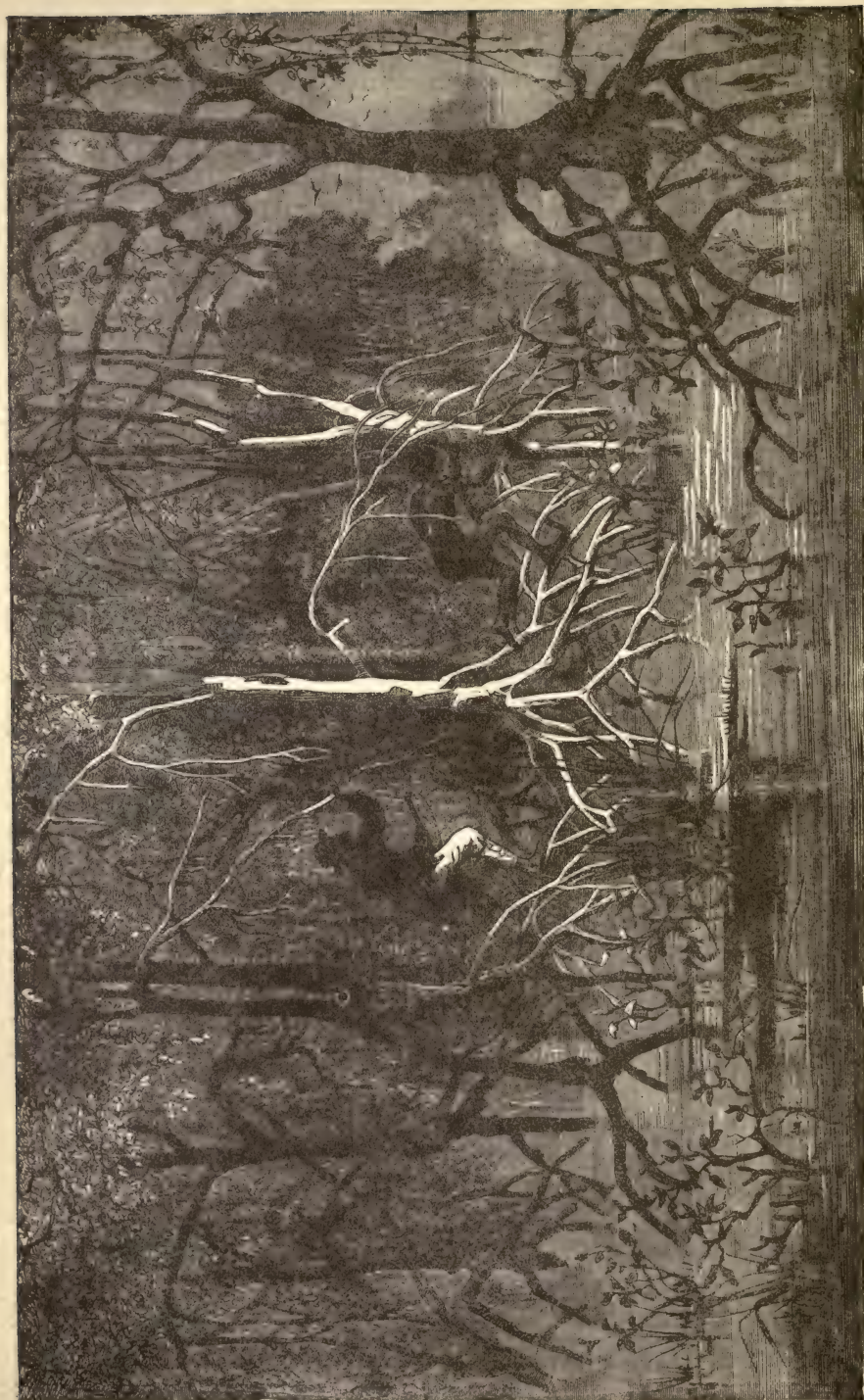
One of the arms of the Delta, through which the Zambesi pours its waters into the sea is the Congone. A richly colored picture unfolds itself before the eyes of the explorer who attempts to travel by it into the interior of the country. The first twenty miles is shut in between marshy lands and mangrove trees, the latter often draped in valuable lichens, which, however, do not seem to be gathered. Giant ferns, shrub-like palm trees blended here and there with the wild date palm, are seen throughout the forest, but the greatest number of trees found in them are the mangrove tree, or rhizophora.

These true amphibious plants do not love to be fettered to the earth, but throw out wide-spreading roots into the bed of the river, and not content with this, send down from their wide-spread branches aërial roots like strong ropes, which strike root as soon as they touch the ground, providing the parent stem with fresh support and nourishment, but making the tangle of roots by the shore almost impenetrable. The clusters of their pale yellow fruit contrast pleasantly with the bright green leaves, but are not good to eat. In many places patches of milola, with large pale yellow blossoms, cover the shore. Rope is made from the bark of this plant, and it is principally used for the lines to which the harpoons are fastened; harpooning being the favorite method of the natives for capturing the hippopotamus.

As we advance, screwpines become visible, and on passing from the Congone into the Zambesi we find some of them as high as church steeples, and Livingstone tells us of the remark made by an old sailor who said that to finish off the picture "there only wanted a grog shop by the church." Further on, the lemon trees begin to be visible. The sombre woods re-echo to the joyous, merry song of the kingfisher. As the steamer ploughs through the winding river bed, a pretty little heron or brilliant kingfisher rises with a cry of terror from the river bank, flies before us for a short distance and settles quietly down, to be scared away again in a little time. The beautiful fish hawk sits on the crest of a mangrove tree, to digest his breakfast of raw fish: he has made up his mind not to stir, and it is only when we are close upon him that he spreads his wide wings and takes to flight.

Billowy Sea of Fire.

The brilliant ibis, with its keen sense of hearing, catches the unaccustomed sound from afar, and springing up from the mud, where it is enjoy-



HUNTING EXCURSION THROUGH A MANGROVE FOREST.

ing a quiet family dinner, is far away before the danger approaches, uttering a loud hoarsely contemptuous ha ! ha ! ha ! as it flies. The rhizophora are now behind us, and in their place stretch wide levels of rich black earth, covered with giant grasses, which rise above the hunter's head, and so make the chase impossible. When the grass withers, it is set on fire, and the conflagration prevents any great abundance of trees from being grown ; for only a few varieties, such as a fan palm, are able to escape the sea of fire which rages every year across the grassy plains. Between the bananas and cocoa palms on the right bank of the river appear several of the native huts ; they stand only a few feet above the moist ground, and are built on piles and entered by means of ladders. The soil is very fertile, and the gardens are really excellent. Rice is grown in great abundance ; batatas, gourds, tomato, kohl, onions, peas, and a little cotton and sugar-cane are obtained. It is said that in the course of a few years the potatoes lose their taste, and assume the flavor this product has when frost-bitten.

It was Leuwenhœck who first of all noticed that the vegetable seed contains the young plant in miniature, traced out in the midst of its envelopes, and only waiting for favoring circumstances to expand its leaves and flowers. Thus, looking philosophically at the subject, we may say that certain plants are viviparous. There are even some in which the impatience of the embryo is so great, that in order to reach the air and light more quickly, it precipitately escapes from its egg while this still adheres to the mother.

Extraordinary Mangrove Tree-Fish.

This peculiarity is seen in the mangroves, strange plants, half-tree, half-fish, living half-plunged in the sea or the lagoons of tropical America and India. Suspended above the water by their bent branches, often quite covered with oysters, these trees let drop through their foliage long roots of embryos which have germinated in the fruit. These, perfectly adapted to the work they have before them, are like little pointed clubs, and have attained a length of from ten to fourteen inches at the time when they are to fall into the water ; so that they sink deep into the mud which encircles the mother plant and form a family group around her.

Some parasites germinate on the plants or animals on the surface of which we find them. This occurs in the microscopic fungi which attack our hair and beard, and bring on most harassing diseases, tetter and tineæ, as the labors of the microscopists of our day have placed beyond a doubt. Similar to these are certain parasitic plants, which are never found except upon certain insects.

At other times germination takes place under very strange conditions. Vandermonde saw children in whose noses peas had germinated from having been imprudently introduced. Another physician, Bréra, mentions having opened the body of a soldier whose stomach was filled with barley which was developing itself there.

Plants, like animals, have a circulation. It is to that universal genius Claude Perrault, at one and the same time physician, architect, and naturalist, that we owe the discovery of this phenomenon. The sap, which is in fact the blood of the plant, circulates through its vessels by means of a power possibly greatly exceeding that which drives the blood through the arteries of an elephant. The celebrated Hales made a very curious experiment on this subject. Having fitted a long tube to the stem of a young vine which he had severed, he saw this fluid rise forty-four feet high. These results appearing very extraordinary to the French physiologists, they soon repeated the experiments of the foreign philosopher, but they were greatly astonished to see that they were within the mark. In fact, De Candolle, who was one of the last to move in the matter, noticed that the force with which the sap rises in the vessels of the plant is equal to the pressure of two atmospheres and a half, or to the weight of a column of water eighty feet in height.

Tremendous Enginery of Trees and Plants.

Thus in an occult function, which is performed so mysteriously in the vegetable kingdom, experiment reveals a powerful energy—an energy which surpasses the visible and tumultuous circulation in the largest animals. Many authorities have stated, not without some foundation, that the sap rises in the vessels of the vine with at least five times as much force as the blood circulates in the crural artery of the horse—the most important blood-vessel of the thigh—and with seven times as much force as in the same vessel in the dog.

It is certain that the blood which the heart projects so violently into the vessels of large animals is not driven with so much power as impels the sap in its ascending movement. Indeed, experiments made on the ox and horse have shown that the impulse given to the arterial blood would only raise a column of blood about 6 feet $6\frac{3}{4}$ inches; the advantage is therefore not at all on the side where it was supposed to be, since according to what has been already stated, the vegetable circulation raises a weight fourteen times greater than does that of the largest mammals.

Thus there are vessels of plants, which though not so thick as a hair, are yet more powerful than those of animals that are thicker than the finger. After having made his experiments on the force of ascent in the



THE WINE-TREE OR WINE-BEARING SAGO-PALM.

sap, Hales attempted to ascertain the rapidity with which it moved. In order to arrive at this point, he hollowed out a deep hole in the soil, laid bare a small root of a tree, introduced it into a tube filled with water, and plunged the tube into mercury. To his great astonishment he very soon perceived that the metal rose in the tube half an inch per minute.

The sap is formed and moves with such force in certain plants, that it is not uncommon to be able to extract a large quantity of it in a short space of time. The sugar-maple, scattered over our northern states, produces a bucketful in a day. It is from this tree that they get the maple sugar consumed throughout the country.

In the tropical countries a tree yields a product not less precious to man—a wine ready made. This is nothing else than the sap of a species of palm—the wine-bearing sago-palm, which grows in Western Africa, and the name of which characteristically indicates the benefits it yields. This vinous sap is mild and sweet when first drawn, but a few hours afterwards it ferments, and then becomes a most intoxicating drink. It is very widely used, and the tree yields it in profusion. The negroes quickly fill their calabashes with it by hanging them to the petioles of the leaves, which for this purpose are cut off soon after their birth.

The vegetable circulation has such energy, and the liquid which it bears away is produced at such a rate, that Scott assures us that out of certain birch-trees there flows, in spring, a quantity of fluid equal to their weight.

Strange Things Locked up in Trees.

Some few years ago, when a large tree in the environs of Orleans was cleft, a cavity quite closed up was found towards its centre, containing a death's-head and crossbones. The astonishment of the public was extreme, and the prodigy was talked about everywhere. But really the whole turned upon a vital phenomenon of which physiology gives a complete explanation. At a distant epoch some anchorite of the forest, having probably hollowed the tree, prostrated himself and prayed before these human relics, which he placed in the excavation. Then the recluse having disappeared in the course of years, nature took up the work again and ingeniously preserved the oratory by covering it with thick woody layers.

During the siege of Toulon a ball from the English fleet entered deep into the stem of a pine standing near the town. The wound is now invisible. Should this tradition be lost, how astonished would any one be, on cutting down the tree, to find this enormous mass of iron! Generally the denser plants are, the slower is their growth; on the contrary, the softer their tissues the more rapidly are they developed.

Certain plants astonish us in this respect, and there are even some, the vital energy of which is so active, that we can in some measure pry into the secrets of their evolution; accordingly Cavanilles conceived the idea of seeing the plant grow. For this purpose he directed strong glasses, furnished with a horizontal micrometric thread, upon the end of the stem of certain plants, just as astronomers do when they place the cross-thread of the telescope athwart a star of which they want to ascertain the movement. The Spanish botanist made his observations principally on agaves and bamboos. With the latter the experiments might yield very clear results, as they grow with such rapidity that we sometimes see them attain the height of a three-storied house in a month.

A bamboo which grew a few years ago in one of the green-houses of the public gardens in Paris, lengthened its stem at the rate of about five inches and four-fifths daily, so that it could easily have been seen growing, as its upward movement was as quick as that of the large hand of a time-piece, the motion of which is visible.

But a still more extraordinary fact is noticed with respect to certain fungi, and it may be said of them, without hyperbole, that they grow visibly. This is the case with the gigantic lycoperdon which, springing from a seed so small that it absolutely escapes our sight, reaches the size of a gourd in one night, so that it may be said without any exaggeration that this plant, of a most degraded order, acquires a bulk which our children require ten years to attain. This fungus being only composed of microscopic cells, an immense number are required to make it up, and besides, they must grow with prodigious rapidity.



GIGANTIC PUFF-BALL OF ONE NIGHT'S GROWTH.

CHAPTER XXII.

PERILS OF MOUNTAIN AND DESERT.

Creation a Museum of the Marvelous—Awful Mountain Peaks with Veiled Faces—Mont Blanc—Sovereign of Mountains—Attempt to Ascend the Giant of the Alps—Ambitious Young Naturalist—A Complete Failure—Snowy Chasms—Afraid to Sleep—Determined to Conquer or Die—Trembling on the Mountain's Edge—Adventures of Jacques Balmat—Blinded by Exposure—Daring Expedition—Scaling Snowy Precipices—On the Far Summit—Miserable End of Balmat—World Startled by an Alpine Tragedy—A Russian Traveller—Twelve Guides—"Cowards!"—Forward—An Awful Disaster—Hurled Headlong Hundreds of Feet—Death in the Deep Abyss—Bodies Left in the Yawning Gulf—Running Frightful Risks—Miraculous Escapes—Recent Ghostly Discoveries—Rivers of Ice—Famous Mer De Glace—Flower Garden in a Desert of Snow—Hospital of St. Bernard—Travellers Caught in the Storm—The Great St. Bernard Dog—Rescuing the Perishing—Exploits of the Dog "Bass"—Dangers of the Desert—Cyclones and Columns of Hot Sand—Air that Scorches Man and Beast—Graphic Description of the Storm—Adventures in Africa—Zambesi Falls—Perilous Ascent of a Nile Cataract.



MYRIADS of interesting and curious discoveries, facts and marvels, have already excited our astonishment and admiration in these pages. If there is anything in the whole world to cause surprise, impart useful information, captivate the imagination, hold the reader spell-bound, and so fascinate him as to render him eager for each new disclosure, we are confident that it is to be found in this volume, which may justly be called an epitome of the marvelous in every realm of creation.

But before passing to the second book, and diving into the manifold mysteries of the vasty deep, that great storehouse of wonders, we are to complete our survey of the land by a tour of the mountains and deserts. Behold, then, the awful peaks whose bald heads veil their faces at times with clouds, and the wide, sandy plains, those oceans on shore, as they may properly be called, which abide from age to age in their forbidding desolation and solitude! These must not be overlooked.

Mont Blanc, as far as Europe is concerned, may justly be sung as—

The Monarch of mountains,

which the genius of nature crowned

On a throne of rocks, in a robe of clouds,

With a diadem of snow.

Let us examine some of the narratives of the different attempts which

have been made at various epochs to climb this immense colossal mass, regarded as inaccessible by man until the close of the last century.

The summit of Mont Blanc is 15,739 feet above the sea-level. Prior to the celebrated Horace Benedict de Saussure, no person had conceived the idea of climbing its scarped flank. It was not even known whether the rarefaction of the air at elevations so lofty would not prove fatal to human life.

Saussure was not twenty years old when he first dreamed of attacking the giant of the Alps. In his first visit to Chamouni, in 1760, the young naturalist published it abroad in all parts of the valley that he would give a sufficient reward to the guides who discovered a practicable route to Mont Blanc. He even promised to pay the day's wages of those whose attempts proved fruitless. But his liberal offers led to no result.

It was not until fifteen years afterwards, in 1775, that four guides of Chamouni succeeded in making the perilous ascent. After triumphing over the obstacles which opposed their progress on the glaciers, incessantly intersected by immense crevasses, the four guides penetrated into a great valley of snow, which seemed as if it would directly approach Mont Blanc. The weather was exceedingly favorable; they encountered neither too precipitous slopes nor too wide crevasses, and apparently all things promised success. But the rarefaction of the air, and the reverberation of the sun's rays on the dazzling surface, fatigued them beyond endurance. Succumbing to weakness and weariness, they found themselves constrained to re-descend, without having met with any insuperable obstacle.

An Attempt Ending in Failure.

Seven years later, three other guides of Chamouni, made the same attempt, following in the track of their predecessors; only they took the precaution of passing the night on the Montagne de la Côte, and did not venture until the following morning upon the glacier which ascends from it.

After traversing it in safety, they followed up the vale of snows which rises towards Mont Blanc. They had already reached a great elevation, and were pressing forward in blithe confidence, when the boldest and most courageous among them was suddenly seized with an unconquerable longing for sleep. He begged of his comrades to continue the ascent without him; but they refused to abandon him in such a condition, or to suffer him, as he wished, to sleep on the snow. Renouncing their enterprise, they all returned to Chamouni.

It is certain that even without the accident of this inopportune lethargy, these three men could never have reached the goal of their adventurous expedition. They would have still had a long distance to travel before

arriving at Mont Blanc, and the heat fatigued them excessively. Moreover, they were without appetite; the wine and the provisions which they carried possessed no attractions for them. So that one said seriously that if he had to recommence the enterprise, he would not load himself with any provisions, but take only an umbrella and a smelling-bottle. When we picture to ourselves a robust mountaineer scaling the slopes of the Alps with an umbrella in one hand and a flask of eau de Cologne in the other, we gain, by this singular image, a vivid idea of the anomalous difficulties and unfamiliar conditions which are associated with the adventure.

Looking at the annexed engraving, the reader will be able by the figures to locate the various mountains as named below :

1. Mont Blanc, 15,739 feet.—2. Dôme du Gouter, 14,400 feet.—3. Aiguille du Gouter, 15,550 feet.—4. Glacier des Bossons.—5. Glacier de Tacconay.—6. Aiguille du Midi, 12,850 feet.—7. Chaîne du Brévent et des Aiguilles Rouges.

Again Compelled to Retreat.

On the 12th of September, 1785, at eight o'clock in the morning, Saussure and Bourrit, Canon of Cologne, accompanied by five mountaineers loaded with provisions, furs and coverings, philosophical instruments, straw and fuel, began their march to the conquest of Mont Blanc.

After five hours of this fatiguing labor, the incline gradually grew steeper, and the quantity of fresh snow augmented at each step. Balmat, therefore, went forward to survey the remainder of the ascent, but speedily returned with the information that the newly fallen snow was so dense in the upper parts that the summit could not be attained except at the risk of life, and that the mountain-peak was covered two feet deep in snow, which rendered progress impossible. His gaiters were, in fact, covered with snow even above the knee.

Great as was the regret which they experienced in abandoning an enterprise so auspiciously commenced, Saussure and Bourrit wisely resolved to prosecute it no further. At the point where they halted the barometer showed an elevation of 11,250 feet. The guides now urged an immediate departure. The sun's rays had melted the snows and rendered the descent dangerous. But walking cautiously, and supported by their guides, the travellers returned without accident to the plateau at the base of the Aiguille du Gouter, and thence re-descended to the cabin.

The rock on which this enterprise had been wrecked was the lateness of the season. Saussure resolved to repeat the attempt in the following year, but at an epoch which should render less probable and less formid-

PANORAMA OF MONT BLANC AND SURROUNDING MOUNTAINS.



able the obstacle of fresh-fallen snow. As a preliminary, and to lighten as far as might be the fatigue of the last day's ascent, he ordered his favorite guide, Pierre Balmat, to construct a new hut at a point considerably above the Pierre-Ronde—that is, at the foot of one of the ridges of the Aiguille du Gôûter. He recommended him at the same time to make various explorations on that part of the mountain, so as to determine on the most feasible route.

Pierre Balmat took to himself two other guides, and on the 6th of July 1786, they went to pass the night in the hut at the Pierre-Ronde. They started at day-break, and following the same track which Saussure had taken, ascended to the Aiguille, and finally to the Dôme du Gôûter; but not without severe suffering from the rarefaction of the air.

While Pierre Balmat and his friends were ascending the Aiguille du Gôûter by the incline of the Pierre-Ronde, three other Chamouni guides attempted it by another route. As it was then believed that the Dôme du Gôûter was the only way by which Mont Blanc could be approached, some of the Chamouni guides had divided into two troops to test the comparative facilities of the two routes leading to the Dôme. François Paccard, Michel Cachat (surnamed *The Giant*), and Joseph Carrier, composed the second detachment. They were joined by another guide, Jacques Balmat, who for some years had been independently seeking the road to Mont Blanc, and for whom was reserved the glory of first discovering it.

Risking Life on the Mountain's Edge.

The two groups of guides having reunited, traversed a vast snow-field, and gained the long ridge which connects the Dôme du Gôûter with Mont Blanc. But this ridge, which strikes between two precipices, each 6000 feet in height, is so narrow, and of so abrupt an ascent, that it proved utterly impracticable to reach Mont Blanc by it. The guides only acknowledged this evident fact with much reluctance. Jacques Balmat, however, persisted in continuing the adventure. He risked his life on the narrow ridge, and to move forward was obliged to place himself on all-fours upon the species of *dos d'âne* (ass's back) formed by this terrible escarpment. His companions, frightened at his temerity, abandoned him, and redescended to Chamouni.

After brave but fruitless efforts, Jacques Balmat was forced to desist from his impossible enterprise. He retraced his steps, still straddling along the ridge, like a child on his grandfather's stick. But he found himself deserted by his companions, who, we may add, felt no great sympathy for him, because he had followed them without their consent. The gallant mountaineer, piqued by their cowardly abandonment, resolved to remain

alone in these frozen wastes and desolate wildernesses until he had discovered a practicable mode of ascending Mont Blanc. Instead of returning to Chamouni, he descended to the Grand Plateau, where he resolved to pass the night.

The Grand Plateau of Mont Blanc is a slightly-inclined plane, of about 2000 square acres, situated upwards of 9750 feet above the sea; swept by continual avalanches and exposed to the most biting winds; for it is surrounded on all sides by peaks of snow, where the traveller can find neither rock nor stone to serve as a shelter or a resting-place. Even during the summer, and in the sun, the thermometer here marks always zero. In this awful desert Jacques Balmat, without covering, having only his mantle and his alpenstock, spent the night, crouching under a crag, and but poorly defended against a small, drizzling, frozen snow, which fell incessantly.

Finding a Pathway to the Sovereign Peak.

At daybreak he resumed his explorations of the mountain. It was thus that he discovered the proper direction in which to climb the "sovereign peak"—namely, by following up the valley of snow which stretches from the point known as the Grands Mulets, and ascending from thence to Mont Blanc by a moderately steep acclivity. The bad weather, snow, excessive cold, and want of provisions prevented Jacques Balmat from pushing forward to the goal; but, in redescending the valley, he ascertained with exactitude the actual course to be pursued in order to gain the summit.

On returning home, Jacques Balmat slept for eight-and-forty hours without once awakening.

The incessant refraction of the sun's rays upon the snow had so fatigued his sight, that he suffered severely from diseased eyes. A physician, named Paccard, who resided in Chamouni village, relieved him from the ophthalmia. In gratitude for his cure and acknowledgment of his skill, Balmat revealed to him his great discovery, and proposed to him to share the glory of accomplishing the first ascent of Mont Blanc. Dr. Paccard accepted the proposal joyfully.

On the 8th of August, 1786, the two adventurers commenced their daring expedition. They had only confided to two persons the secret of their project before carrying it into execution. So they accomplished alone this lengthened and dangerous route, which our Alpine climbers now-a-days do not attempt except with a numerous and well-provided escort. All their stores consisted of a couple of woolen coverlets, in which to wrap themselves at night under the shadow of some projecting

rock. It is difficult to understand how these two men, reduced to their own resources, in the midst of these desolate wastes, these ice-bound deserts, which had never before been trodden by human foot, could reach the goal they had proposed to themselves, in spite of the snows and the precipices, the cold, and the rarefaction of the atmosphere. But it is certain that, after passing the night under a rock on the plateau of the Grands Mulets, they ascended, on the following day, to the "monarch of mountains."

The Miracle Performed.

The inhabitants of Chamouni, meanwhile, had assembled in crowds, and, by means of their telescopes, could perceive the two heroes on the topmost peak of Mt. Blanc—that is, of the loftiest mountain in Europe, which had hitherto been considered utterly inaccessible to man. Jacques Balmat and Paccard remained for half an hour on the horse-shoe ridge which forms the actual summit. But, owing to the continual reflection and dazzling gleam of the sunlit snows, Paccard, when he regained the valley, was almost blind; while Balmat's face was swollen, his lips were congested with blood, and his eyes were sorely fatigued.

"It is strange," said Paccard to his companion next morning; "I hear the birds sing, and it is not day!"

"That is because you cannot see," replied Balmat; "the sun has risen, but the swelling of your eyelids renders you temporarily blind."

Happily this accident had no fatal consequences. Dr. Paccard died in 1830, at the ripe age of seventy-nine. As for Jacques Balmat, he perished miserably, in 1834, at the bottom of a precipice. Some vague rumors had induced him to believe that a vein of gold existed on the flank of one of the lofty peaks which shut in the valley of the Sixt on the northeast, and he started in search of it. But the place indicated proved inaccessible; it was necessary to advance along a narrow cornice, beneath which descended, sheer and sombre, into the abyss a precipice nearly four hundred feet in depth. The sight froze his blood with terror. But sometime afterwards, accompanied by a chamois hunter, as rash and intrepid as himself, he renewed the attempt. He ventured on the narrow cornice—a few steps—and he disappeared in the abyss! His body was never found.

A Tragedy that Startled the World.

It was with a purely scientific object that Dr. Hamel, councilor of the Russian court, betook himself, in 1821, to the foot of Mont Blanc, to scale its snowy peak. This eminent man of science travelled at the cost of the Russian Government, to undertake certain inquiries into the physical con-

dition of the globe, and was everywhere attended by a train of all kinds of instruments of observation. We shall describe the ascent of Mont Blanc attempted by the Russian physicist, not for any scientific results obtained from it, but on account of the catastrophe which abruptly terminated it, sad recollections of which are still fresh in the valley of Chamouni.

On the 3rd of August 1820, a first attempt was made by Dr. Hamel, *via* the glaciers of Bionnassay and the Aiguille du Goûter; but the outbreak of a storm, and the cloud-masses which hung upon the mountain, compelled him to descend.

It was on the 18th of August that he recommenced his ascent. He was accompanied by two English gentlemen, Mr. Dornford and Colonel Gilbert Henderson. Twelve guides escorted them, under the leadership of Marie Coutet.

Having started from Chamouni at six A. M., it was four P. M. when they arrived at the Grands Mulets. It is here that travellers always halt to pass the night. A part of this rock is shaped like the letter L; a ladder and some poles covered with canvas were arranged against it, so as to form a sort of triangle, in whose interior Dr. Hamel and his companions spent the night, lying upon straw. But in the evening the weather grew stormy, and the rain began to fall. The atmosphere was heavily charged with electricity, and the balls of the electrometer danced so rapidly to and fro as to excite alarm. Throughout the night the thunder never ceased to peal.

Storm in the Mountains.

All the following day the rain continued, and the snow, which at first only fell upon Mont Blanc, began to approach the region where our travellers had encamped. The bad weather lasted through the second night, which was spent, like the preceeding, under the miserable shelter of the tent.

The commonest prudence should have dictated to the travellers an immediate return to Chamouni. The guides, having consulted together at day-break, were unanimously of this opinion; but when they intimated their decision to Dr. Hamel, he formally rejected it. It was then determined that three guides, Jacques Coutet, Joseph Folliguet and Pierre Favret, should go to Chamouni for a supply of provisions, which were now running short.

It had been settled that they should rest quietly in their encampment until fair weather returned; but at 8 A. M., on the sky brightening, Dr. Hamel decided he would immediately set out. The guides, who realized

all the peril of traversing in the midst of frightful precipices the fresh fallen snows, refused to obey so imprudent an order; one of them, Auguste Teiraz, burst into tears; he threw himself into the arms of a comrade, exclaiming: "I am a lost man! I shall perish on the mountain!"

This sinister presentiment was verified, for Auguste Teiraz was one of the victims of the catastrophe. Colonel Henderson himself was of the same opinion as the guides, but Dr. Hamel, stamping his foot, and looking the Englishmen full in the face, muttered the word "Cowards!" An Englishman, after that, could no longer hesitate. Each person made his preparations in silence, and they began the ascent. The first part of the journey was accomplished without accident, and the weather became very bright and beautiful. Without much difficulty they ascended the Dôme du Gôûter, and reached the great plateau which extends at the base of Mont Blanc.

Halting for a Hearty Breakfast.

"Here," says Dr. Hamel, in his narrative of the event, "our guides congratulated us, saying that we had now surmounted every danger; no more crevasses, no more hazards. Never had an ascent been accomplished more quickly or with less difficulty; in fact, the snows had just the degree of consistency suitable for easy marching; they were not too hard, and yet the feet did not sink too deeply in them. No one felt ill, though all of us had for some time experienced the effect of the rarefaction of the air; my pulse beat one hundred and twenty-eight times in a minute, and I felt an incessant thirst. Here our guides invited us to breakfast, for, said they, up higher you will have no appetite.

"A tablecloth was spread on the snow at the threshold of the great plateau, and it served both for chairs and table. Everyone ate with gusto his half of a fowl; I made various arrangements for my experiments, and the observations which I proposed to take on the summit. I wrote two notes to announce our successful achievement, leaving only a blank to be filled up with the exact hour. It was my intention to attach them to a pigeon which I had brought with me, and which I proposed to release on the summit, to see how he flew in so rarefied an air, and also to ascertain if he could retrace his way to Sallanches, where his mate awaited him. We preserved a bottle of our best wine to drink on the peak to the memory of De Saussure.

"At nine o'clock precisely we resumed our journey, and toiled towards the summit which rose before our wistful eyes. 'Would you take a thousand pounds,' said one of my companions to his countryman, 'to go back instead of ascending?' The reply was, 'I would not return for any

sum that could be named. We were so full of hope and joy at seeing immediately within our reach the goal of our enterprise."

At this moment the travellers were ascending what the guides call "the hood of Mont Blanc," that is, the last snowy incline which leads to the top-most peak. At the foot of this glacier yawns an immense crevasse of ice, twenty yards in width and fifty in depth. They now marched in single file, one after another; the first guide was Pierre Carrier, the second, Pierre Balmat, and the third, Auguste Teiraz. Next came Julien Devoissous and Marie Coutet. Behind these, still in single file, marched five other guides, Dr. Hamel, and the two Englishmen.

It was probably this order of march which led to the catastrophe. By advancing in a single line, they furrowed, as with a ploughshare, the newly fallen snow, which had not yet had time to consolidate with the old. Thus divided by a long section, the portion of snow which the caravan had trampled separated suddenly; it glided over the other snow. All the party was carried with the avalanche down the steep declivity at whose base opened, as if to engulf them, the immense crevasse to which we have referred.



AWFUL CATASTROPHE IN THE CHASMS
OF MONT BLANC.

The mass of frozen snow which in this wise broke loose was 1000 yards in length, by seventy in breadth, but not three feet in depth.

Everybody was thrown down and rolled in the snow. The three guides who led the way, Pierre Carrier, Pierre Balmat, and Auguste Teiraz, were dashed headlong into the crevasse. Julien and Marie Coutet, propelled by a more violent impulse, were fortunate enough to sweep across the abyss and fall into another crevasse, happily not so deep, and half full of snow, from which they were easily extricated. By a merciful Providence, the other guides, Dr. Hamel, and the two Englishmen, arrested their descent on the border of the gulf. They had rolled over and over from a height of 300 feet.

Crushed and Buried under Snow and Rocks.

Julien Devoissous and Marie Coutet remained a moment without consciousness. Julien, with his head beneath him, was wounded all over with blows received against the narrow sides of the crevasse. Marie Coutet was half buried in the snow, which filled this chasm for a depth of sixty feet. Embedded up to his neck, he was unable to make any movement, and his face wore the purple color of asphyxia. He called with a struggling voice to his companion; Julien, having succeeded in liberating himself, made use of his alpenstock to clear away the snow which covered his friend's body. The two mountaineers remained for some minutes seated opposite one another without uttering a word; they thought that they alone had survived this fall.

Happily it was not so. Several of their comrades, having almost miraculously escaped the avalanche, clung to the edge of the crevasse which had so nearly proved their tomb. One of them, Mathieu Balmat, contrived to slide along it, and to carry assistance to the others. He threw to them a hatchet, with which they hewed out steps in the ice. When they had gained a sufficient height he extended to them an iron-tipped pole, and drew them out of danger.

In the depths of the Frightful Abyss.

The travellers now found themselves assembled in one spot; they counted their numbers. Three guides were missing; the three who had formed the vanguard. They had fallen into the great crevasse. Mathieu Balmat had seen them precipitated into its abyss; and Julien Coutet, at the very moment of his own fall, and while rolling over and over, had noticed something like a black-colored leg flash rapidly before his eyes, and descend in the crevasse; undoubtedly it was Auguste Teiraz, who wore black gaiters—the same who had shown so lively an apprehension when Dr. Hamel, in defiance of warnings and counsel, had given the imperious order of departure.

Doctor Hamel was prostrated with regret and pain. As for the two Englishmen, words cannot describe their keen remorse. They flung themselves down upon the snow; they seemed temporarily bereft of reason. They declared they would not quit the accursed spot until they had recovered, dead or alive, the three unfortunate men of whose loss they accused themselves.

In spite of the remonstrances of the guides, Mr. Dornford and Dr. Hamel descended into the great crevasse, their bodies half buried in the soft snow. They sounded everywhere with their iron-tipped staves, but encountered no resistance. With all their strength they shouted the names of the missing guides; but at so immense an elevation the rarified air produced but feeble sounds.

Presuming that they were buried under a thick stratum of snow, Hamel thrust in his staff to its entire length, and stretching himself on the surface, he held the staff firmly with his teeth; then he listened with profound attention. But there came no answer; nothing troubled the silence of that lugubrious sepulchre.

A Grave in Eternal Snow.

They were compelled to discontinue the fruitless search. Dr. Hamel and his companion returned to the plateau. The unfortunate guides were lying at least 150 feet deep in the snow. There was no recourse but to abandon them, and, since that epoch, no tourist who makes the ascent of Mont Blanc can pass without a throbbing heart the abyss of ice where perished so miserably the three inhabitants of the valley.

As the day advanced the cold became icy; for at that elevation our travellers had nearly attained the height of Mont Blanc itself. They had spent two hours in fruitless search on the borders of the great crevasse; it was absolutely necessary they should begin the descent, if they did not wish to be overtaken by night and darkness in the midst of the precipices, and incur the hazard of being frozen to death.

The guide Mathieu Balmat then drew near to Dr. Hamel, and looking him full in the face, even as the doctor had confronted him on the morning of that fatal day,—

“Well, sir,” he exclaimed, “are we cowards; and will you still ascend?”

The doctor replied by giving the signal of return. He would fain have persuaded some of the guides to pass the night on the edge of the crevasse, and there await the succor which was hastening up from Chamouni. It was, perhaps to doom them to death. The suggestion, therefore, was received by the guides with indignant remonstrances, and

they reproached the foreigner with having caused by his obstinacy the death of their comrades.

Strange and Painful Sensations.

On their homeward route each related the sensations he had undergone at the moment of the descent of the avalanche. Julien Coutet had rolled over thrice before, bounding across the great crevasse, he fell into the small one. He attributed his safety to the circumstance that he carried, slung across his back, the barometer-case of the doctor, which had held him momentarily suspended on the brink of the abyss, whence he had rebounded like a ricochet shot. Marie Coutet had seen four of the five guides who preceded him fall with their feet uppermost; only one seemed to preserve his upright attitude. As for himself, he had felt hurled along like a cannon ball, and in the twinkling of an eye, lo, he was lying half buried on a bed of snow! A second afterwards, another of his comrades seemed to drop from heaven by his side; it was Julien Devoissous.

The only one of the guides not swept away by the avalanche was Mathieu Balmat. Divining what had happened; comprehending, with the instinct of a mountaineer, that the new snow had separated, from the old, and was gliding in one mass down the incline; gifted, moreover, with prodigious physical strength, he thrust his long iron-tipped pole through the recent snow, which was not above three feet deep, and planted it in the older and indurated soil. By exerting all his energy he was able to cling to the pole, while the avalanche carried away beneath him his companions and his brother, Pierre Balmat, to find a sudden and terrible death at the bottom of the abyss.

Fortunate Escape for Some of the Party.

Thrown down and rolled over like the others, Dr. Hamel had found himself fortunately checked on the edge of the crevasse. Colonel Henderson was driven much nearer the fatal brink, and had only been arrested in his headlong course by the mass of snow which surrounded him. He was completely interred in it, even his head being covered, and was only extricated from it with great difficulty. On arriving at the Grands Mulets they met the three guides despatched in the morning to obtain a supply of provisions, and who now returned with the rest of the expedition. All these brave mountaineers, struck with a kind of stupor, deplored with one voice the death of their comrades, and the distress into which the event had plunged their families.

The two Englishmen contributed very generously to their relief, but Dr. Hamel, whose conduct throughout was characterized by want of feel-

They reached the foot of the mountain with their hands on their knees, and they

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the mountain, whose summit throughout was characterized by water to the

ing and a headstrong arrogance, took no part in providing for them. Nothing, however, could console the mother of one of the three victims, Pierre Balmat. She wept incessantly; three months afterwards she died.

Ghastly Discoveries of a Recent Date.

On the 15th of August, 1861, was fulfilled the last episode of this sorrowful tragedy. A Chamouni guide discovered on the glacier des Bossons two human skulls with their integuments, and an arm with the hand still adhering, the whole clothed in ruddy flesh. A few fragments of bags, and clothes, and other signs, left no doubt that these ghastly wrecks had belonged to the two guides, Pierre Balmat and Pierre Carrier. Finally, on the 1st July, 1863, forty-three years after the catastrophe, the glacier des Bossons surrendered some additional human remains; a foot, covered with its flesh and nails, still attached by the muscles to a fleshless tibia. By the side of the foot lay a compass, probably Dr. Hamel's, which the guide Auguste Teiraz had carried. It was a grandson of the victim, Joseph Teiraz, photographer of Chamouni, who chanced upon this sad discovery.

Many ascents of Mont Blanc have been undertaken since those described in the preceding pages. Mountaineering has, in truth, become a mania; in England an "Alpine Club" has been formed for its scientific development; and the Mont Blanc route is now so well defined that it has been successfully accomplished by ladies. Few adventurers, however, escape without some more or less dangerous mishap; and there seems much good sense in the words with which Captain Sherwill, one of the number, ends a recent narrative:—"I advise no one to undertake an ascent, for the result can never have an importance proportionate to the dangers which you must incur, and in which you must involve others."

Rivers of Ice.

Among the most wonderful phenomena of the mountains must be mentioned those great frozen rivers which move so slowly toward the valleys, yet never melt.

Even Lord Macaulay's school-boy knows by name the famous Mer de Glace, or Eis-see, of the Chamouni valley. We know that words, when wielded by a master-spirit, are powerful to move the hearts and agitate the minds of men; to realize the highest dreams of the poet's fancy and embody the airiest creations of the romancist's; but, assuredly, no words can convey even the feeblest idea of the wonders of this vast frozen sea—girdled, as it is, by a giant range of frozen mountains—lit up by a

myriad fantastic and ever-shifting rainbow hues, and rendered awful by its intense solitude and silence!

All that expands the spirit, yet appalls,
Gathers around;

and nowhere does man feel more terribly dwarfed and humbled by a sublimity which he is wholly unable to comprehend!

The most striking portion of the Mer de Glace is the Glacier de Talèfre, where a solitary rock, about seven acres in extent, and nowhere less than 9000 feet above the sea, is clothed with beautiful herbage, and, in August, dressed out in flowers—an oasis of poetry in the midst of the most awful desolation—a Calypso's island set in a sphere of azure ice—the *Jardin*, or Garden, as it is appropriately called, of a palace of Titans.

The Mountain Traveller's Friend.

Situated between Switzerland and Savoy, is one of the most dangerous passes of the Alps. In these regions the traveller is often overtaken by the most severe weather, even after days of cloudless beauty, when the glaciers glitter in the sunshine, and the pink flowers of the rhododendron appear as if they were never to be sullied by the tempest. But a storm suddenly comes on; the roads are rendered impassable by drifts of snow; the avalanches—huge loosened masses of snow or ice—are swept into the valleys, carrying trees and rocks before them.

Of the Monastery, nearly on the top of the Great St. Bernard, Rogers says:

It is a pile of simplest masonry,
With narrow windows and vast buttresses,
Built to endure the shocks of time and chance;
Yet showing many a rent, as well it might,
Warred on for ever by the elements.

Not a bush is to be found near the edifice; even the wood for its fires is fetched from the Forest of Fewet—a distance of four leagues. Even in the height of summer it always freezes there early in the morning. The Hospice is rarely four months clear of snow; its average depth around is seven or eight feet, and sometimes there are drifts rising to the height of forty feet against it.

Its inmates have been pictured by Rogers as

Answering, and at once, to all
The gentler impulses—to pleasure, mirth;
Mingling, at intervals, with rational talk,
Music; and gathering news from them that came
As of some other world. But when the storm
Rose, and the snow rolled on in ocean waves,
When on his face the experienced traveller fell,

Sheltering his lips and nostrils with his hands;
 Then all was changed ; and, sallying with their pack
 Into that blank of nature, they became
 Unearthly beings !

So, not merely in poetry, but in fact, it often occurs. It is a rule of the Monastery, that every day, whatever the weather may be, two able men, called *maroniers*, accustomed to the mountains, should proceed, the



CELEBRATED ST. BERNARD DOGS RESCUING A TRAVELLER.

one towards the Italian side, the other towards the Vallais. They traverse the pass during the whole of the day, each one attended by a dog—with a flask of spirits fastened to his neck—keeping a path opened in the snow, and watching for passengers. If the *maronier* meets with any person bewildered or exhausted, or his dog intimates that any one is under the snow, he instantly renders aid, or runs to the Hospice to gain assistance. Conducted thither, all that is practicable for the sufferer is done promptly and zealously.

The dogs originally were brought from Spain. The monks, having neglected to keep up a larger stock of the old race, it was nearly destroyed by a malady, about forty years ago, when, from necessity, the present race was introduced. One of them, named Barry, saved a great number of lives; and another dog, called Jupiter, was also very successful. One day he saw some person pass the Hospice, and immediately set out after the traveller. After some time, his absence was remarked, and one of the *maroniers*, pursuing his track, found him posted over a drift of snow where a poor woman, with her child, were about to perish. But these he was the instrument of saving from death.

Sir T. D. Lauder had a puppy of about four or five months' old, presented to him by a friend, who brought it from the Great St. Bernard.

Dog Acting as Postman.

When a dog attacked Bass, as he was called, in the street or road, he would run away, rather than quarrel; but, when compelled to fight, he turned upon the foe, threw him down, and then, without biting him, would lay his whole immense bulk down upon him till he was nearly smothered—a mode of treatment which was attributed to his youth.

Of his strength, the following is an instance:—It was the duty of the postman—to whom Bass took a special fancy—besides delivering letters, to take a bag from one receiving house to another, and this he gave the dog to carry, which followed him through all the villas in the neighborhood, where he had deliveries to make, and always parted with him opposite to the gate of the Convent of St. Margaret's, and returned home. When his owner's gate was shut, to prevent his following the postman, the dog always leaped a high wall to get after him.

One day, this postman, from some cause or other, sent another man in his place. Bass went up to him, curiously scanning his face, whilst the man rather retired from the dog as if anxious to decline his acquaintance. But Bass, following, showed strong symptoms that he meant to have the post-bag, while the man seemed equally intent on retaining it. At length, as all Bass' civil entreaties failed, he raised himself on his hind legs, put a great fore paw on each of the man's shoulders, laid him flat on his back in the road, and coolly walked away with the bag. The man got up, much dismayed, following the dog, and trying, in vain, what coaxing would do; but he was relieved at the first house he called at by being told that the dog always carried the bag. Bass walked with the man to all the houses at which he had to deliver letters, and along the road till he came to the gate of St. Margaret's, where he dropped the bag, and, making his bow to the postman, returned home.

Not alone on the mountains is human life endangered. Whirlwinds and tempests sweeping hill and sandy plain are the breeders of destruction.

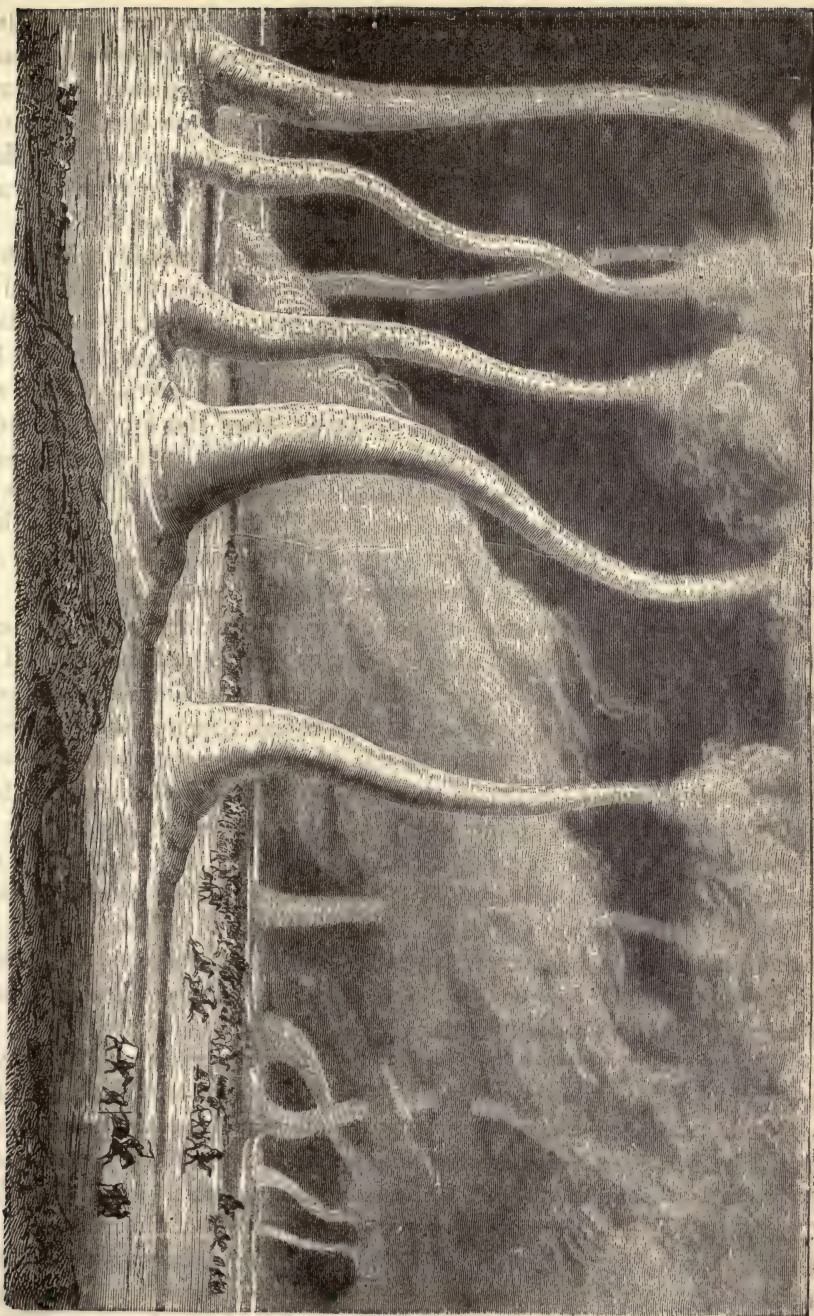
Violent whirlwinds are often seen in the midst of great conflagrations. A cane forest surrounded by a few isolated trees on the border of the Black Warrior River in Tuscaloosa, Alabama, broke out into flames, which spread over a surface of twenty-five acres. Whirlwinds of various forms were seen in the hottest part of the fire. At first they were comparatively slight, not exceeding thirty-five or forty feet in height, but as the fire spread they rose to a height of more than two hundred feet. The flame and the smoke arising from the whirlwinds were wholly distinct from the general mass sent up by the fire. Even when the fire had burnt out in a great part of the forest, the whirlwinds still rose above the ashes. The wind was blowing from the northeast when the fire broke out, but shortly afterwards the wind blew near the ground from all sides toward the centre of the fire. The columns of smoke rose more than six hundred feet vertical in the air, and then suddenly bent toward the southwest, clearly showing where the north wind struck them.

Fires Producing Whirlwinds.

Immense whirlwinds are often seen accompanying the large clearing fires of the backwoods. Seven acres of timber and brushwood were fired at Amherst, Mass., on a warm windless day, when the smoke and flame united in a large, whirling, cylindrical column, accompanied by violent roaring. At a similar fire in Stockbridge, the whirlwind was so violent that it tore up young trees six to eight inches thick, and hurled them fifty feet high in the air. Similar whirling columns have been observed above the craters of active volcanoes. On the 8th of April, 1866, a pillar of ashes rose above the volcano of Santorin during an eruption, with the usual thunder and rumblings, and suddenly shot up in the form of an immense steam screw to a height of 19,000 feet. Sometimes the vapors contained in the whirlwinds condense above the column of smoke, and form clouds, sending down lightning and rain.

The simplest form of the whirlwind is that observed on calm days, on large squares or cross roads, when sand and leaves are lifted and whirled round for a few seconds. Dust whirlwinds of considerable size are sometimes observed in the Russian steppes; but the best known phenomena of this kind are the high sand pillars of Sahara, which have been falsely reported to be able to bury whole caravans. Even in Australia these rotary dust pillars are met with, generally being seen upon shadowless plains. It is thought that these Australian whirlwinds are the channels which carry the heated air from the ground to the higher strata.

TERRIFIC CYCLONE HURLING COLUMNS OF DESERT SAND IN THE AIR.



Instead of the rolling waves and cool breezes of the sea, this funereal region only gives out burning gusts, scorching blasts which seem to issue from the gates of hell; these are the simoon or poison-wind, as the word signifies in Arab. The camel-driver knows this formidable enemy, and so soon as he sees it looming in the horizon, he raises his hands to heaven, and implores Allah; the camels themselves seem terrified at its approach. A veil of reddish-black invades the gleaming sky, and very soon a terrible and burning wind rises, bearing clouds of fine impalpable sand, which severely irritates the eyes and throat.

Dreadful Destruction by Sand-Storms.

The camels squat down and refuse to move, and the travellers have no chance of safety except by making a rampart of the bodies of their beasts, and covering their heads so as to protect themselves against this scourge. Entire caravans have sometimes perished in these sand-storms; it was one of them that buried the army of Cambyses when it was traversing the desert.

Camp, in his charming work on the Nile, describes in the following terms one of these desert tempests. It comes towards one, he says, growing, spreading, and advancing as if on wheels. Its overhanging summit is of a brick color, its base deep red and almost black. In proportion as it approaches it drives before it burning effluvia, like the breath of a lime-kiln. Before it reaches us we are covered with its shadow. The sound it makes is like that of a wind passing through a pine-forest. So soon as we are in the midst of this hurricane the camels halt, turn their backs, throw themselves down, and lay their heads upon the sand. After the cloud of dust comes a rain of imperceptible stones, violently hurled about by the wind, and which, if it lasted long, would quickly flay the skin from those parts of the body unprotected by the clothes. This lasted five or six minutes, and was frightful. Then the sky became clear again, and gave the same feeling of sudden change to the eye as a light suddenly brought into a dark place.

Whirlwinds are generally preceded by a sultry, oppressive air; sometimes by absolute calm; but the state of the wind never appears clearly connected with the phenomena. The storm pillars vary greatly in form; the sand columns being generally funnel-shaped, and the water-spouts like a pipe surrounded at the base by whirling vapors and foaming water. The height and diameter are also variable; some of the highest have been estimated at 6,000 feet. In many cases the damage caused by the water is of such a kind as to show that there has been an influx of air from every side toward the base of the column.

BOOK II.

THE SEA.

CHAPTER I.

MONSTERS OF THE GREAT DEEP.

The Ladders of the Titans—The Watery Desert—A Great Unknown—Mysteries of the Deep—Marvelous Products—Terrible Marine Monsters—The World-Renowned "Kraken"—Battle with a Strange Foe—The Great Sea-Serpent—Singular Stories—Old Sailors' Narratives—The Huge Ocean Giant—Curious Habits of the Whale—Perilous and Exciting Adventures—A Miraculous Escape—The Flying Dragon—A Fish with Spikes—Seized by a Shark—The Stomias-Boa—The Hammer-Headed Shark—The Siamese Twins of the Sea.



TO behold the sea! It is the dream of every landsman, citizen or peasant, who dwells in the interior of an ocean-washed country, however little he may care for the grand scenes of nature. The mountains attract in the same manner the inhabitants of the plains, but not so strongly. He may, with some degree of effort, embody them for himself with the aid of the pictures he has seen, or the descriptions he has read. Certainly, when at a later time fortune permits him with admiring eye to view these gigantic monuments of our planet's ancient convulsions; when he sees, on the platforms which are but their first steps, the enormous masses rising, on whose flanks the vast forests appear like patches of moss, and which are in their turn surmounted by piles of rocks with summits apparently piercing the celestial vault, he discovers but a faint resemblance between their reality and the conceptions he has formed of them.

And if he undertakes to climb these ladders of the Titans; if, at an elevation of some thousands of feet, he casts his glance over the plains; if he peers down into the abysses lying open before his steps; if he marks the cascades leaping from crag to crag with a thunderous roar and burying themselves in gulfs where whiten their foamy waves; if he climbs to the wintry regions where the rocks are of ice, where the soft moss and crisp green turf are replaced by perpetual snows, where he is lost—as it were—in space, where legions of moving clouds hide the earth from his vision,

where the difficult air impedes his respiration : then he will think of the paltry landscapes below with a scorn attempered by pity.

But the mountains are still the earth. There man may live on the proceeds of the chase or of his industry. There he may build himself a house. There flourish plants and animals with which he is familiar. He marches there with a firm foot. The very dangers that threaten him—the precipice, and the torrent, and the storm, and the avalanche—are only an enlargement, so to speak, of those which everywhere surround him. In a word, he is as much at home on the mountain-peak as in his own fields ; the form and aspect alone are different.

Grandeur of the World of Waters.

But it is otherwise with the ocean. He who has never seen it can form no just conception of it. Vainly does he seek a resemblance in the master-pieces of the painter's art, in the great rivers, the great lakes, the vast extent of the plains, farms, or prairies. Nothing can ever paint to him the liquid immensity. Brought face to face with ocean, he will remain speechless and stupified. And what will it be if he goes down to the deep in ships, loses sight of earth, and finds himself suspended between the water and the sky, sustained above the abyss by a few planks ? Over his head, the infinite space ; under his feet, a capricious and shifting element—capricious, at least, in appearance—to day, calm, benign, and motionless ; to-morrow, furious and implacable, hurling one against another its foam-crested waves, longing to engulf his frail bark in their formidable embrace.

It is then that he will feel the sentiment of his own weakness growing upon him, with the idea of infinity. His temerity will at first astonish and terrify him. He will think with admiration of the forgotten hero who first dared to launch himself upon the sea in a boat, and confront the unknown ; of those who, bolder still, undertook the desperate enterprise of discovering the end, the boundary of the watery desert—sailing, sailing from the other side of the world, until they should meet with the land seen by the mind's eye beyond the horizon. Then the tranquil courage of the seamen, their skilful manœuvres, their familiarity with this great liquid world, which they both know and love ; all this tends by degrees to reassure him. A certain enthusiastic pride will succeed the humble dread of his first moments ; he will enjoy man's fierce struggle against the elements. If a storm break forth, he will rejoice to witness it, as a young soldier, after the first few musket shots, feels a fierce delight in the battle. And as the soldier, when once more seated by his fireside, proudly exclaims : " I was in that war ; I fought on such and such a famous field ; "

he too, in his turn, will cry, "I have beheld the sea; and not only from the harbor, the pier, and the summit of the cliff, but I have seen it beneath my feet; I have seen it alternately serene and stormy, agitated and asleep; I have bounded o'er the waves to the roaring of the tempest; I have struggled against it—and here I am!"

Mysteries of the Sea.

This indeed is a fortunate man, for he has seen the ocean. But has he seen it truly? No. For the ocean is not, like the mountains, an accident on the surface of the earth; it is a world, two and a half times as large as our own, if we consider only its surface, and it envelops ours on every side. It is a world which nourishes legions of strange beings in its depths, in its vast coal forests. It is a world which man, after so many centuries, at the cost of so many sacrifices, scarcely begins to know, far from having conquered it.

Like to the great gods of the ancient barbarians of the North and the East, the ocean—a greedy and terrible power—makes us pay every year by hundreds of human lives for the favors it bestows upon us. How many has the enormous Sphinx devoured of those who have attempted to divine its enigmas, to pierce its mysteries! What matters it? The work goes on, and goes forward. The human eye has penetrated that formidable night. Science already comprehends the laws which govern the marine world and connect it with the terrestrial, and has learned the part which the seas perform.

It has done more. By a series of inductions based on an examination of the constitution of our globe, it has succeeded in ascending to the origin of things; in unlocking, so to speak, the archives of nature, and composing a history of the ocean, a history so logical, so satisfactory to the mind, so harmonious with existing facts, that we cannot refuse to accord it a very high degree of certainty.

Marvelous Products of the Ocean.

We are to study the ocean in its actual condition; its regular or tumultuous movements, the causes which produce and the laws which govern them. Exploring the shores of the seas, their surface, and abysses, we see developed the prodigious series of beings which inhabit them: fantastic plants; rudimentary animals scarcely distinguishable from plants; microscopical creatures which swarm in incalculable myriads, agitate, labor, and multiply—molluscs, crustaceans, fish, reptiles, gigantic amphibians, even birds; for among the winged race there are hundreds of species which belong to the marine not less than to the aerial world.

We show the ocean ploughed in every direction, excavated in its depths and explored by man, and exercising a powerful influence on the progress of science and civilization; less, indeed, by the immense riches which it offers to our greed, than by the obstacles which it opposes to our encroachments, and by the problems which it proposes for us to solve.

Extraordinary Marine Monster.

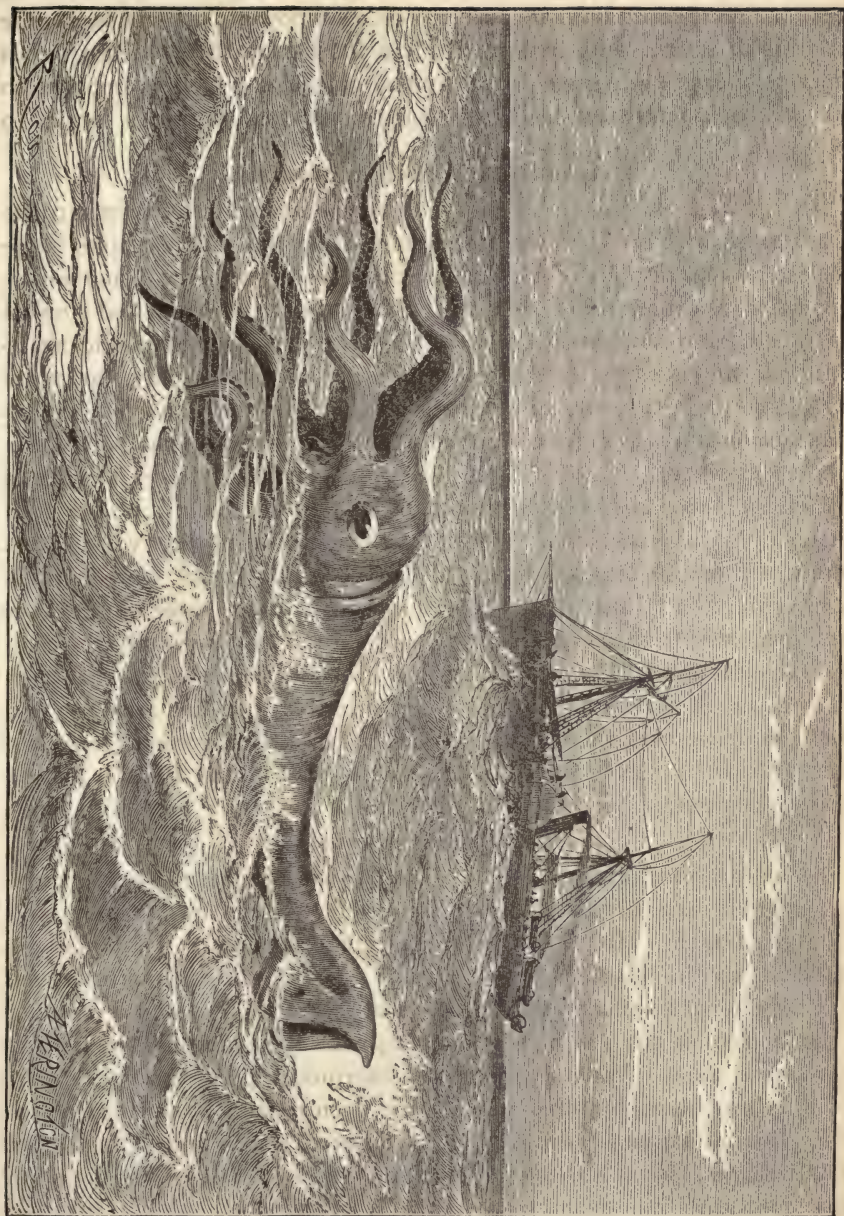
No forms of life on our globe are more calculated to awaken surprise than those which are found in the mysterious depths of the ocean, strange stories and descriptions of which have come to our notice. Many wondrous tales are on record of gigantic polypi, living in the polar and tropical seas; fierce and redoubtable monsters, of size and strength sufficient to overcome and devour the largest whales, and, consequently, far more easily able to destroy any unfortunate mariner who may have fallen overboard, or incautious swimmer who ventures to sport in the waters frequented by them. Accounts are given of monstrous creatures, capable of entangling ships, and of seizing with their arms not only men, but even whales of huge dimensions. Mention is made of a monster whose arms were thirty feet in length, and so thick that a man could scarcely clasp them. Mention is also made of other animals of the same kind, whose arms measured from seventy-five to one hundred and twenty feet! Finally, the celebrated "kraken," which has been the theme of so many romances, was of no less a girth in its upper portion than half a league, and would have capsized the largest vessels, had not their crews severed the arms with which it held them. The truth is, that in the Pacific Ocean a species does exist of enormous development.

The Huge Octopus.

One of the most eminent of modern naturalists, Ehrenberg, has communicated to the Berlin Academy of Sciences some observations well deserving notice. His paper, relates to soundings made on the Greenland coast by the English ship *Bull-dog*. He says the accounts given strikingly accord with the old legends that tell of marine monsters living at the bottom of the sea, and enveloping with their arms all things that approached them. What Pliny says of enormous polypæ thirty feet long, and weighing seven hundred pounds, has been regarded as an exaggeration. But an immense creature was captured which might be called "whale-slayer," for it was taken while engaged in a struggle with one of these giants of the sea. Some portions of the body of this gigantic polypus are preserved in the Copenhagen Museum.

We cannot, therefore, doubt that the depths of the sea, where vegeta-

MONSTROUS POLYPUS MET BY THE STEAMSHIP "ALECTO."



bles flourish eight hundred feet in length, are also peopled with monstrous animals, whose organism is adapted to these unknown regions, whence they but rarely emerge. Their very real appearances have formed the basis of the mysterious traditions which, for two thousand years, have been transmitted from generation to generation of mariners, and which have given birth to the fantastic creations of the kraken and the sea-serpent.

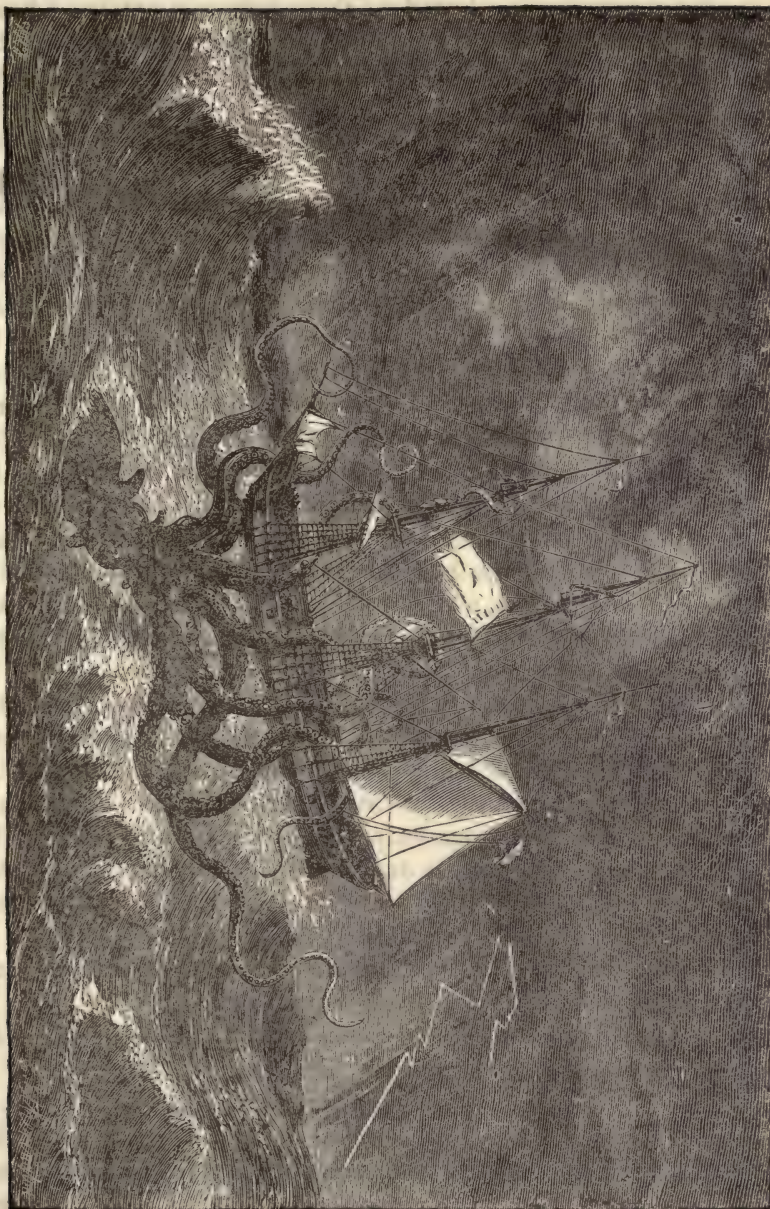
Almost simultaneously with the appearance of Ehrenberg's paper, Berthelot, the French consul at Teneriffe, minutely related an encounter with a gigantic polypus, in the open sea. On the 2nd of December 1861, said Berthelot, the steam despatch-boat *Alecto*, commanded by Lieutenant Bouyer, dropped anchor in our roads on her voyage to Cayenne. This ship had encountered at sea, between Madeira and Teneriffe, a monstrous polypus swimming at the surface of the water. This animal measured from sixteen to eighteen feet in length, without counting the eight formidable arms covered with air holes, that encircled its head. Its color was a brick red; its eyes, placed level with the top of its head, were prodigiously developed, and glared with a frightful fixedness. Its mouth was like a parrot's beak. Its body, much swollen towards the centre, presented an enormous mass, whose weight might be computed at about 4400 pounds. Its fins, situated at its posterior extremity, were rounded into fleshy lobes of a very great size.

It was on the 30th of November, about half an hour after noon, that the crew of the *Alecto*, descried this terrible cephalopod swimming alongside. The commander immediately stopped his vessel, and despite the animal's dimensions, manœuvred to catch him. A slipknot was made ready; muskets were loaded, and harpoons prepared, in all haste. But at the first balls fired the monster dived underneath the vessel, quickly reappearing on the other side. Attacked anew with the harpoons, and after receiving several discharges of musketry, he disappeared twice or thrice, each time showing himself a few moments afterwards at the surface, agitating his long arms. But the ship continued to follow him, or rather checked her course according to the animal's movements. This chase lasted for two or three hours.

A Struggle with a Strange Foe.

The captain of the *Alecto* grew anxious at all risks to capture this novel kind of foe. Nevertheless he durst not hazard the lives of his sailors by lowering a boat, which this monster would have readily capsized by seizing it with one of its formidable arms. The harpoons aimed at it penetrated its soft flesh, and flew back without inflicting any mortal in-

THE HUGE CUTTLE-FISH ATTACKING A SHIP.



jury. Several balls had hit it in vain. At length it received a shot which seemed to wound it seriously, for it immediately vomited a great quantity of froth and blood mixed with glutinous matter, which diffused a strong odor of musk. It was at this crisis that the sailors contrived to catch it with the running knot, but the rope glided along the mollusc's elastic body, and only stopped when near the extremity at the junction of the two fins. They attempted to haul it aboard, and already the greater portion of its body was clear of the water, when its enormous weight drew the rope right through its flesh, and separated the hinder portion from the remainder of the animal. Then the monster, released from its bonds, fell back into the sea, and disappeared.

Whatever may be the reality of the facts with which we have just been busy, and the scientific value of the commentaries suggested by them, we must acknowledge that the story of the gigantic polypus, the subject of such marvelous tales, is deficient neither in grandeur nor poetry. It is undoubtedly of Danish or Norwegian origin, as is shown by the completely northern sound of the name of "kraken" bestowed upon the monster. According to the ancient legend, the kraken is a foul, colossal beast, of shapeless body, with arms as long as the longest serpent, and covered with innumerable suckers. He does not content himself with attacking the other denizens of the ocean; he lusts after the flesh and blood of man. It is especially at night and in the fury of the tempests, that he rises from the bottom of the abyss to assail the unhappy voyagers overtaken by the whirlwind. It then embraces the masts and rigging with its gigantic arms, and endeavors to drag down under the seething waters the ship and all on board. The sole means of escape is by severing its tentacles with blows of an axe; yet it is by no means certain that they will not grow again immediately, like the heads of the hydra. It is easy to understand the terror with which the recital of the frightful exploits of such an enemy must formerly have inspired ignorant minds prone to superstitious fancies.

The Famous Sea Serpent.

The fabulous history of the great sea-serpent ascends, like that of the giant polypi, to a sufficiently remote antiquity. Pliny and Valerius Maximus both describe an amphibious serpent swimming in the shallow shore-waters, and only sailing out to sea when he had grown to such dimensions that movement became impossible for him, or, at all events, very difficult, anywhere else than in mid-ocean. A French author, Belleforest, in his "Cosmographie," comments on the passage in Pliny

referring to this marine serpent, and does not hesitate to furnish the most circumstantial details respecting it. According to him, though of colossal dimensions, it was gifted with extraordinary agility. It flung itself on barks and small ships, capsized and dashed them in fragments by striking them with its huge tail, and afterwards swallowed all their crews. Belleforest adds, with admirable simplicity, that if the ship was too large for the creature to crush it, it drew, or rather propelled it towards the shore, in whatever direction the wind blew; then waited patiently until the seamen, compelled by hunger or in the hope of escape, ventured upon deck or attempted to gain the shore. That was the moment for it to pounce upon them and crush them with its teeth—for teeth it had, according to Belleforest. It had also the head of the wolf-dog, with ears pricked back behind. Add to this a body covered with yellowish scales, and a croup curving in tortuous folds, and you will have an exact portrait of the monster; the same, in all probability, which Neptune stimulated to devour the son of Theseus.

Belief in the Existence of a Terrible Monster.

In the north of Europe, a belief in marine creatures of strange form and prodigious dimensions is widely spread and deeply rooted in the minds of the masses. Fishermen and sailors confuse the kraken properly so called, or gigantic polypus, and the great sea-serpent, designating both by the name of kraken, and liberally attributing to them the most astonishing and incompatible characteristics and forms. Norway has an unconquerable faith in the reality of the great sea-serpent, and ascribes it to the northern seas for a dwelling-place. Pontoppidan, Bishop of Bergen, says that the Norwegians cherish so strong a belief in the actual existence of this monstrous reptile, that whenever he spoke of it in a dubious manner, his listeners broke into a quiet laugh, as if he had doubted the existence of the eel or any other common fish. The name of the ocean-serpent in these regions is the kraken; they also refer to it by a name which signifies the scourge of the sea.

The Norwegian fishermen, says Pontoppidan, all affirm, without the least contradiction in their accounts, that the monster covers a mile and a half of ocean with the upper portion of its back. The fish, surprised by its ascent, flutter a moment in the humid hollows formed by the protuberances of its external envelope; then from the floating mass issue numerous spikes or shining horns, which rear themselves erect like masts crossed by their yards. These are the arms of the kraken. Here, then, is a resuscitation of the kraken; the serpent transforms itself into a polypus: it has arms, and what arms! Such is their vigor, that if they seize

upon the rigging of a ship of the line, they will infallibly capsize her! After remaining some time on the waves, the monster redescends with the same slowness, and the danger is not less for the vessel which may be within its range; for, while sinking, it displaces such a volume of water as to occasion whirlwinds and currents not less terrible than those of the famous Maelstrom.

Such is in Norway the popular belief respecting the sea-serpent. The old Scandinavian writers attribute to it a length of 600 feet, with a head resembling that of the horse, black eyes, and a kind of white mane. According to them, it is only met with in the ocean, where it suddenly rears itself up like a mast of a ship of the line, and gives vent to hissing noises, which appall the hearer, like the tempest roar. The Norwegian poets compare its progress to the flight of a swift arrow. The fishermen say it revolves sometimes in a circle around the doomed vessel, whose crew thus find themselves assailed on every side.

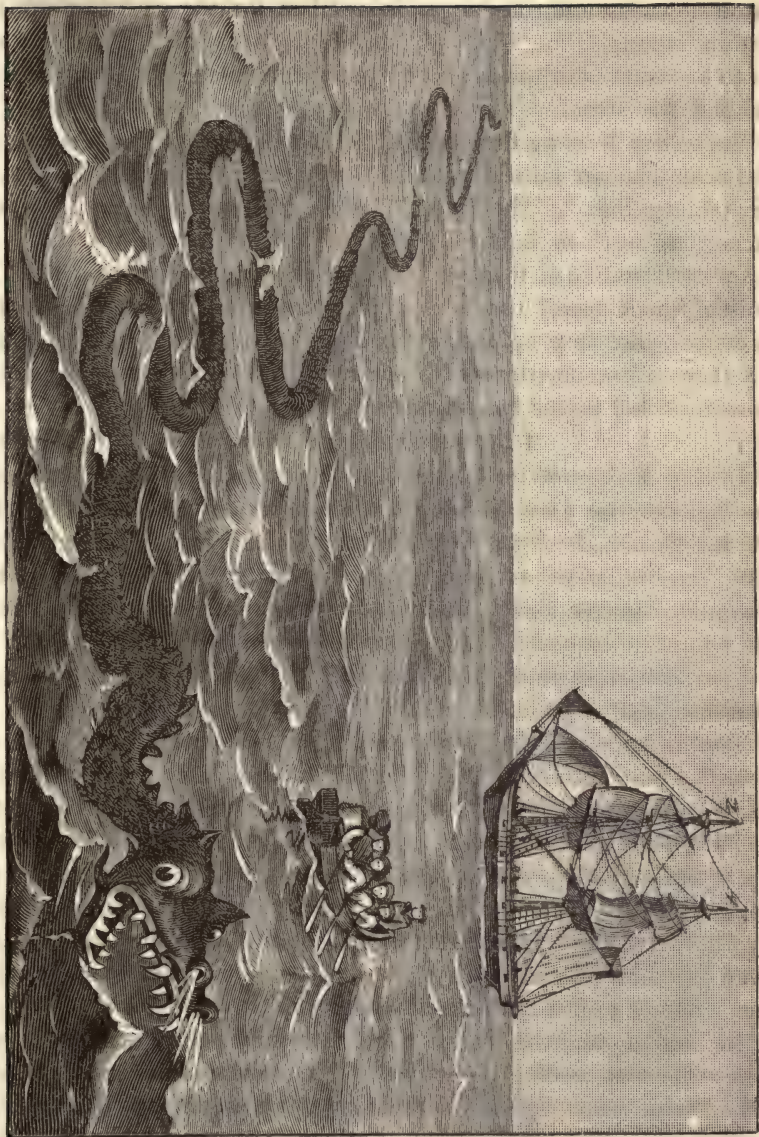
The Terror of the Polar Seas.

In this description of the sea-serpent we think it possible to recognize another fantastic animal, the "great white whale" of the Greenland coasts, hunted for two centuries by the Scotch whalers, which they called "maby dick," and regarded as the terror of the Arctic Seas. According to these mariners it makes its appearance now at intervals; but is of so venerable an age that its body is completely covered by vegetation and marine mosses, in whose midst live attached to it, as to a rock, multitudes of shell-fish and polypi.

The traditions of the North speak also of a marine monster which was stranded one day on the beach of one of the Orkney Islands. It is said to have measured eighty feet in length and fourteen feet in circumference, to have worn a long bristling mane, which, luminous in night and shadow, grew dull and dark during the day. Despite the fantastic character of some of those details, we may add that their general veracity is attested by the depositions taken in presence of the local authorities; and that even a Scotch naturalist, Sir Everard Home, proposed to class this monster among the fish of the *Squalidæ* family.

In England and the United States a belief in the great sea-serpent has always been exceedingly popular. The Linnean Society of Boston published some years ago an authentic report establishing the fact that, at certain intervals, a prodigious monster had been seen in Boston Bay; that on one occasion it showed itself about thirty miles from Boston, and was examined by some competent persons informed of its return. According to the narrative we are speaking of, the monster exhibited the general

A MONSTROUS SEA-SERPENT AS DESCRIBED BY SAILORS.



shape and outlines of a serpent. Its agility was extreme. When the weather was calm and the sun hot, it remained on the surface, alternately plunging in the water and exposing in the air the different portions of its annular body.

In the archives of the town of Plymouth is preserved a long abstract of verbal depositions made by a multitude of seamen, which affirm the existence in ocean of this mysterious animal. And it is a remarkable circumstance that all these depositions, with the exception of some slight differences of detail, fully agree upon the general conformation and enormous dimensions of the monster.

A fisherman attests upon oath to have seen a strange animal, of a serpent's shape, extraordinary size, and brown hue, sometimes basking tranquilly on the surface of the water, sometimes swimming with incredible swiftness. Another witness affirms that he saw in the same locality an immense beast, whose head resembled that of a rattlesnake. A third had seen the monster open its enormous mouth, which he also compares to that of a terrestrial serpent. Other individuals announce similar facts, and accompany them with details which appear very natural. Thus, a seaman relates that he fired a musket-shot at the monster, just at the moment that, having drawn tolerably near the ship, he dived as if to avoid it; but that, at a short distance off, the monster raised its head anew; that they very simultaneously felt the grating of a scaly body against the vessel's keel, and that soon afterwards they saw the serpent's tail lashing the surface of the sea, and making the spray and foam besprinkle the very mariners.

Testimony of an Eye Witness.

Some years ago the *United Service Journal* inserted a letter in which an eye witness described the appearance of the sea-serpent on the shore of Nahant. I had with me, says this witness, an excellent telescope. When I reached the strand I found many persons assembled, and soon afterwards we saw appear, at a short distance from the shore, an animal whose body formed a series of blackish curves, of which I counted thirteen. Other persons estimated the number at fifteen. The monster passed thrice at a moderate speed, traversing the bay, whose waters writhed in foam under its huge bulk. We could easily calculate that its length could not be much less than fifty to sixty feet. This, at least, I can affirm, without presuming to say to what species belongs the animal which I have just seen.

A short time afterward the officials of Essex county, in the State of Massachusetts, received the deposition, formally drawn up, which follows:

I, the undersigned, Gresham Bennett, second master, declare that on the 6th of June, at seven A.M., while navigating on board the sloop *Concord*, on her way from New York to Salem, the vessel being about fifteen miles from Race Point, in sight of Cape St. Anne, I heard the helmsman cry out, and call me, saying that there was something close to the ship well worth looking at. I ran immediately to the side which he pointed out, and saw a serpent of enormous magnitude floating on the water. Its head rose about seven feet above the surface; the weather was clear and the sea calm. The color of the animal in all its visible parts was black, and the skin appeared smooth and free from scales. Its head was about as long as that of a horse, but was the perfect head of a serpent, terminating on the upper part in a flattened surface. We could not distinguish its eyes. I saw it clearly from seven to eight minutes; it swam in the same direction as the sloop, and went nearly as quickly. Its back consisted of humps or rings of the size of a large barrel, separated by intervals of about three feet. These rings appeared fixed, and resembled a chain of hogsheads fastened together; the tail was beneath the water. The part of the animal which I saw measured about fifteen feet in length; the movement of its rings seemed undulatory.

A Novel Discussion.

There ensued in the scientific journals and societies a very animated discussion, but one of novel character, in which everybody took a side for or against the great sea-serpent; only its opponents, instead of denying purely and simply its existence, maintained that what had been taken for an animal was nothing else than some enormous vegetable waif stretched out upon the surface of the Ocean.

Something is due to the influence of ancient traditions and venerable fables, which have been handed down from generation to generation, and which, while powerfully affecting the more credulous and impressible minds, are not without their effect even upon cooler judgments. The superstitions of the past have a strange vitality in them. We pretend to despise, to ignore them; we very learnedly discuss their origin, and expose their absurdity; yet who can say that he is wholly free from their far-reaching power? Unknown to ourselves, perhaps, they color our fancies and direct the course of thoughts, and surprise us into a sudden acquiescence in moments when the cool intellect is off its guard, and the excited brain has surrendered itself to the dominion of fancy. It is to this truth Schiller has so finely alluded in his "Wallenstein," in a passage where Coleridge's translation may be owned to surpass the original:

Still

Doth the old instinct bring back the old names;
And to yon starry world they now are gone,
Spirits or gods, that used to share this earth
With man as with their friend;
Yonder they move, from yonder visible sky
Shoot influence down; and even at this day
'Tis Jupiter who brings whate'er is great,
And Venus who brings everything that's fair.

An Immense Ocean Giant.

The Greenland whale frequently attains the length of seventy feet, but its ordinary dimensions are about sixty. Even the latter is a colossal stature; it presupposes a weight of about seventy tons; and a whale of this length and mass will not be less than from thirty-six to forty feet in circumference, measured a little in front of the pectoral fins. The latter are from seven to ten feet long; the tail, which is triangular in shape, is from eighteen to twenty-two feet broad. Naturalists ascribe to some species still more gigantic dimensions. Thus the Northern rorqual sometimes exceeds ninety-five feet in length; and the two species which inhabit the waters of the Aleutian Islands attain, according to some authorities, the astounding length of 170 feet. The cachalot, or sperm whale, is about the same size as the Greenland or common whale; yet individuals have been discovered, we are told, which, like the rorqual, measured eighty to ninety feet in length.

Nearly all stay-at-home naturalists—the naturalists of the closet—have repeated in their treatises that the blowers, when they rise to the surface of the water for breathing, eject through their vents great spouts of water, which indicate their whereabouts from afar. This fact is universally admitted, and every picture of whales or cachalots represents them with the indispensable jet leaping from the summit of their head. Yet, according to those observers who have seen the whale elsewhere than in books and museums, it is not water which the animal propels through its vents, but the vapor of water, just as all terrestrial animals expire their breath; only this vapor, on coming into contact with the cold air, immediately condenses, at first in a white cloud, and afterwards in a small fine rain. Such, at least, is the statement of Scoresby, no mean authority; and it has been confirmed by an old seaman, a well informed and highly talented man, who spent several years in the exciting pursuits of the whale-fishery, and who has had opportunities of observing some hundreds of these animals.

A profound instinct of sociability seems one of the characteristic

traits of their nature, and this instinct manifests itself, in several species, by the powerful and reciprocal affection of the mother and her young. The same attachment exists between the male and his mate, and, like the maternal sentiment of affection, reveals a touching character, since it almost always prevails over that instinct which in most animals keeps down every other—too frequently even in man himself—the mean, cowardly instinct of self-preservation. The gigantic whale, in spite of its formidable appearance, is a very inoffensive, and usually a very timid animal, ready to fly at the slightest appearance of danger. Yet an intrepid courage is kindled in the breast of this ocean-giant when he sees one of his young attacked or wounded; but his sole object is to withdraw it from its peril, to expose himself in its place to the assaults of the enemy, and if it dies, to perish with it, for the poor beast will never abandon it. Unprovided with weapons, he can in no other wise defend it; nor does he ever make the attempt, for he is wholly deficient in the instinct of combat. He can suffer, but he cannot fight.

Great Destruction of Marine Life.

The whales live in families rather than in herds. Their food is exclusively animal. They prey upon fishes, worms, molluscs, small articulated animals, which they engulf in immense quantities in their enormous throat, ejecting the water they have swallowed, after depositing their prey in the capacious recesses of their stomach. Whales have no teeth in either jaw; but the upper, which is extremely narrow, is furnished with numerous horny laminæ—the whalebone of commerce—descending perpendicularly from the palate, and varying in proportional breadth and length in the different species. The whalebone consists of numerous parallel laminæ, each of which is formed of a central coarse, fibrous layer, lying between two strata, which are compact and externally polished. The filaments are very numerous, and fill up the cavity of the mouth sufficiently to form a most complete and efficient strainer; and as the throat is extremely small, not being large enough to admit even the smaller fish, the food of whales being consequently restricted to very small animals, such a structure is necessary in order to retain the whole of whatever is taken into the mouth.

Enormous Quantities of Oil.

The common, or Greenland whale, is chiefly found in the Arctic Circle, though it is also met with in other parts of the world. Its usual length is sixty feet, and its circumference from thirty to forty feet. The lips are five or six feet high; the tail is of immense breadth; the general color a blackish gray. Its thick cutaneous layer of fat or blubber



A BOAT'S CREW ATTACKING A WHALE.

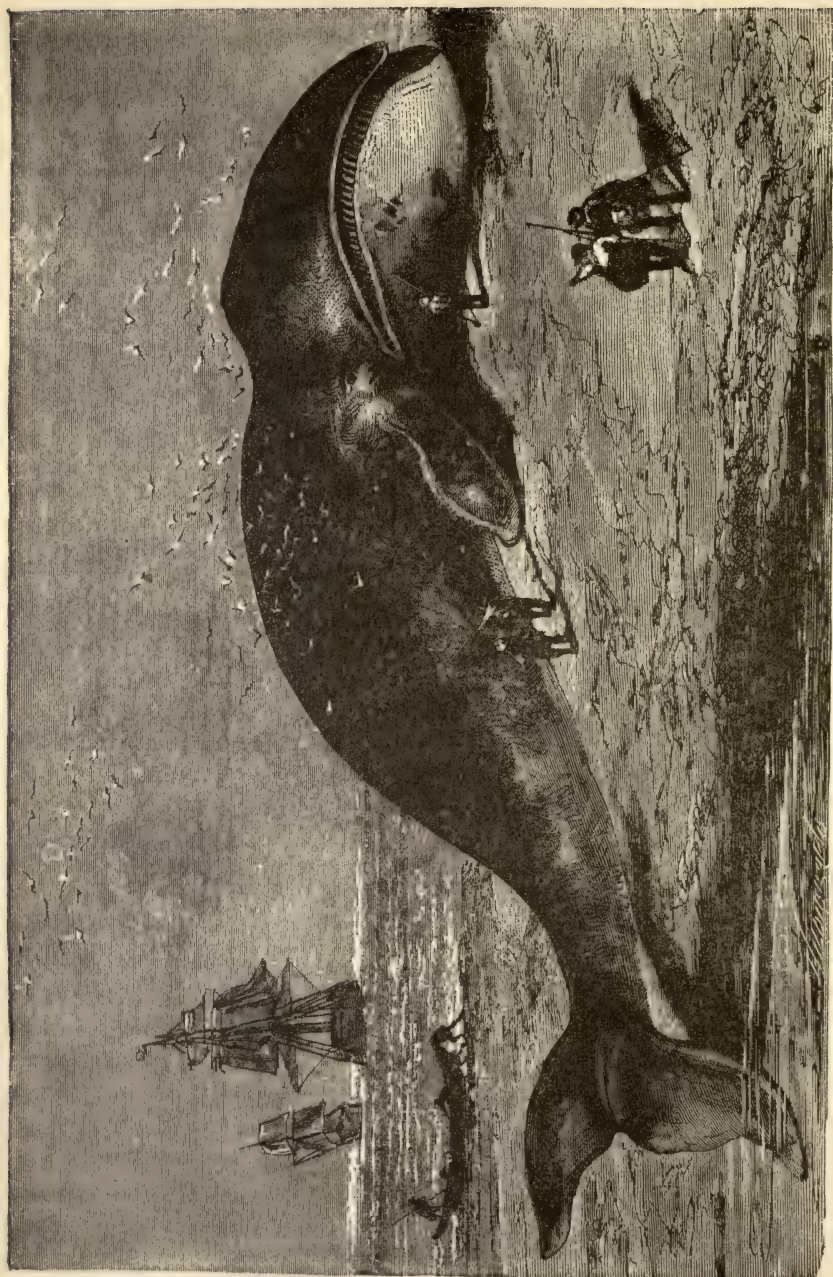
yields a large quantity of oil; upwards of twenty tuns for each whale of ordinary size.

The female of this species, like most others of the cetacea, is extremely attached to her young, and often rushes into the most imminent danger, and even upon certain death, to rescue or defend it. The whalers take advantage of this affectionate attachment, and strike with the harpoon the young whale, quite sure that the mother will before long approach for the purpose of saving her offspring, but frequently, in fact, to perish with it!

Exciting Capture of the Ocean Monarch.

The whaling ships which belong to France, England and the United States, are each of them always accompanied by five or six boats. The boats are generally four-oared, and carry besides the four rowers, a harpooner and an officer. When they have arrived in those latitudes where they hope to find whales, a man is posted on the look-out on some high part of the ship, from which he can see to a long distance. The moment he perceives a whale, he gives the signal agreed upon beforehand, and the boats are launched. In the bows of each of them stands the harpooner; at the stern is the officer. Both, with fixed eye and outstretched neck, watch for the approach of the gigantic creature. This is indicated by an eddy, a submarine vibration, and a roaring like the suppressed noise of distant thunder. The animal has shown the extremity of his black muzzle above the water. We know already by what alternations of blowings and soundings the creature makes its evolutions in the liquid medium. The whaler notices in what manner the whale inclined its tail to guess the direction which it has taken, whether its soundings will be long or short, and then changes his direction according to the requirements of the moment. It is the exact knowledge of these details which makes the expert whaler. So the manœuvres of the boat vary considerably, according to circumstances.

It is easy enough to approach to within fifteen or twenty fathoms of the whale. But the difficulty is to arrive sufficiently near it to allow of a successful attack being made upon it; that is to say, to within two or three fathoms' distance. Blows from the tail and the flippers are now to be feared. When the boat is sufficiently near, the harpooner prepares to cast the harpoon. He stands with his thigh fitting into a hollow of the boat, holding his weapon with both hands. When the officer considers that the favorable moment has arrived, he cries out, "Strike!" When from a false calculation as to distance, awkwardness, or fear, the harpooner has thrown his weapon badly, the whale promptly frees itself from the instru-



ENORMOUS WHALE OF THE ARCTIC REGIONS,

ment which has wounded it, by a sharp contraction of its muscles. As soon as it is free, the animal starts off, and it is then useless to attempt to follow it; it is lost sight of after fifteen or twenty minutes; in most cases its companions accompany it, and are for the future more difficult to approach than they were formerly. If, on the contrary, it is made fast to the boat, it quivers and seems to shrink under the blow; excited by the pain, it prepares to make its escape; hindered in doing this by the dart it carries in its flesh, it at first hesitates, so that an ordinarily skilful harpooner is able to send a second harpoon into it; at any rate in a few minutes it dives.

A Critical Moment.

The officer then changes his place, and proceeds to take his post of action. Up to this time he has directed the manœuvres; now he is going to act himself. More than two hundred fathoms of the line are already in the sea, and the animal is still diving. The force of the plunging is so great, that if there were anything in the way of the rope it would make the boat capsize. The line has been known, as it was unrolling itself, to catch a man by an arm, a leg, or even by the body, and drag him down into the sea, from which he did not rise again till the part caught hold of had been cut through by the friction. It is difficult to form an idea of the coolness required in these preliminary manœuvres: it is necessary to have at the same time great resolution, extreme promptitude, and the utmost prudence. If the first opportunity is missed, all chance may disappear, and the fruit of long labor is lost. To judge from the uneasy air of certain officers, one would say that they were afraid, so anxiously do they look all round, and watch every little thing; but by the direction of the line, they know whether the whale is diving perpendicularly down, swimming along under the water, or mounting to the surface, and they manœuvre accordingly. The crew must blindly obey its officer; it must be nothing but a rowing and back-watering machine, for all of their lives depend on this. In these solemn moments fear takes possession of some sailors. As soon as the whale is made fast, they become of a livid paleness; they lose their heads; they see nothing, hear nothing, and can no longer obey a single command. It is very remarkable, that old sailors are more exposed than young ones to this excessive panic. When men are not soon cured of this unfortunate fear, they cease to make part of the crew of the whale-boat, where their presence could only be demoralizing to the others. Harpooners, too, until then intrepid, have been known to become all of a sudden, and without any apparent cause, incapable of throwing a harpoon with force and accuracy. The simple

fact of the whale being close at hand strikes them with terror; their arms, paralyzed by fear, suffer the weapon to fall flat and harmless on the cetacean, which, warned by this simple touch, escapes as fast as possible. The true whaler knows no fear: he braves death, but is prudent.

A Desperate Flight.

Fortunately the animal does not know how formidable it really is; it is only when it tries to escape that it causes disasters. At each blow the animal makes hoarse and metallic roarings, which can be heard for a distance of miles; what it spouts forth, is white, thick, and rises to a great height, until, after a lucky hit has been made, two columns of blood escape from the blow-holes, rise into the air, and in their fall redden the sea for a great way round; from this moment the whale is considered as good as dead. However, the animal may still be lost; the distance, the night, or the state of the sea does not allow of the vessel following it. On the approach of its death the whale collects all its remaining strength, and in a disorderly flight, without an aim, without any consciousness of danger, without hope of saving its life, it swims along, overturning everything which it meets with on its way. It sees nothing, throws itself at random on the boats, on a rock or on the shore.

Very soon a general shiver runs over the whole body; its convulsions make the sea froth and boil. At last it raises its head for the last time; for the last time it looks for the light, and dies. Having now become an inert body, it turns over and floats with its back downward, the belly on the surface of the water, the head hanging a little down under water, on account of the different weight of the different parts. Its death sometimes takes place during a dive; the carcass then comes to the surface, and floats without our being able to observe the phenomena which accompany its death-struggle.

A Perilous Adventure.

The pursuit of the whale, whether that species which our hardy mariners seek amidst the ice-floes of the Polar Seas, or the still huger kind which wallows in the boundless Pacific, is one full of peril, and its annals are crowded with strange and terrible adventures. Swift and sudden deaths; the shattering of a boat into fragments, and the immersion of the crew in the freezing sea; the dragging of a man into the depths by a turn of the tangled line round his leg or arm are but too common incidents in this warfare with the leviathan. One instance of this last-named accident is on record, in which the sufferer escaped with life, to tell the harrowing tale of his own sensations.

An American whaling captain in the Pacific was fast to a sperm whale,

which "sounded," or descended nearly perpendicularly. The line in swiftly running out became suddenly entangled; the captain was seen to stoop in order to clear it, and in a moment disappeared over the bow. The boat-steerer seized an axe, and instantly cut the line, in hope that, by the slackening, the unfortunate man might become freed. Several minutes had elapsed, and hope had wellnigh become extinguished, when an object was seen to rise to the surface a little way off. It was the body of the captain, which in a few seconds was lifted into the boat. Though senseless and motionless, life seemed to be not extinct, and the usual remedies being applied, he revived, and became, to use his own phrase, "as good as new," when he gave an account of his singular escape.

Suddenly Dragged Overboard.

It appears that in attempting to throw the line, a turn caught his left wrist, and he was dragged overboard by the descending whale. He was perfectly conscious as he was rushing down with great rapidity, and it seemed to him as if his arm would be torn from its socket, from the resistance of his body to the water. Well aware of his peril, he knew that his only chance was to cut the line, but with his utmost efforts he could not raise his right hand from his side, to which it was pressed by the force with which he was dragged through the water.

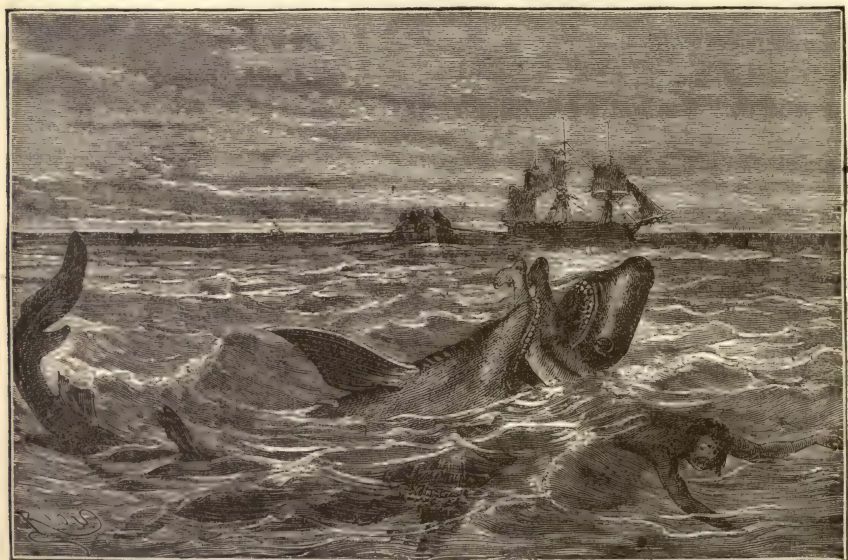
On first opening his eyes it appeared as if a stream of fire was passing before them; but, as he descended, it grew dark, and he felt a terrible pressure on his brain, and there was a roaring as of thunder in his ears. Yet he still remained conscious, and still made vain efforts to reach the knife that was in his belt. At length, as he felt his strength failing, and his brain reeling, the line for an instant slackened by the whale's pausing in its descent; he reached and drew his knife; the line again became tight, but the edge of the keen blade was across it, and in an instant he was freed. From this moment he remembered nothing, until he awoke to light and life and agonizing pain, in his bed.

Devoured by a Shark.

The whale may cause the death of the sailor who pursues him, yet does not devour him. This, however, cannot be said of the great white shark, the voracity of which is well known, many instances of which are on record. About thirty natives of the Society Islands were once proceeding from isle to isle in one of their large double canoes. A storm coming on, the lashings of the two canoes were torn apart by the violence of the sea, and they were separated. Their depth and narrowness rendered them incapable of floating upright when single; and, though the

crew strove hard to keep them on an even keel by balancing the weight, they were every moment capsized. In these circumstances, they endeavored to form a raft of the loose spars and beams, the boards and paddles, which they could get at, hoping to drift ashore thereon. From their numbers, however, compared with the small size of the raft, the latter was pressed so deep, that the waves washed above their knees. At length they saw the horrid sharks begin to collect around them, which soon grew so bold as to seize one of the shipwrecked wretches, and drag him into the abyss.

Another and another followed; for the poor islanders, destitute of any weapons, and almost exhausted with hunger and fatigue, and crowded



IN THE JAWS OF THE GREAT WHITE SHARK.

together on their submerged narrow platform, could neither defend themselves nor evade their ferocious assailants. Every moment made the conflict more unequal, for the sharks, attracted by the scent of blood, gathered in greater numbers to the spot, and grew more and more audacious, until two or three of the mariners only remaining, the raft floated so as to elevate them beyond reach of the savage monsters, which continued to threaten them, and lingered around, until the waves at length bore the survivors to the beach.

The white shark sometimes attains the length of between twenty and thirty feet. His head is of a broad depressed shape, terminating in an

obtusely pointed snout; the huge mouth, capable of admitting the thigh, or even the body, of a man, affords ample room for a thick tongue; the eyes have a bluish or greenish cast, and a peculiar stony glare. The stomach is of vast size, and dilates to an extraordinary degree; the brain is small. Broad, strong and pointed are the pectoral fins. The French name *requin* is derived, it is said, from the Latin *requiem*, and signifies that if a man falls into the sea in the presence of this voracious animal, his comrades may repeat for him the usual prayers for the dead. His swiftness of motion is such that he can outstrip the swiftest vessel, and his strength so great that no unarmed man can cope with him successfully. Observe, too, that his teeth are not incased in bone, like those of quadrupeds, but in cartilaginous sockets, which enables him to raise or lower them at his pleasure. When, therefore, he seizes a victim of more than ordinary vigor, he moves them all, either in succession or simultaneously, and multiplies the number of wounds which he inflicts. With one snap of his powerful jaws, a shark of average size will cut a man in two. We need not wonder, therefore, that he is more dreaded by sailors than any other monster of the monster-haunted deep.

A Creature with Fiery Scales.

Frequently, in the West Indian seas, the negro crew of a boat will cease rowing, and with a significant air indicate to the voyager the hideous form of a shark following in the rear, and apparently waiting for some false movement or sudden accident, which, by capsizing the frail skiff, may provide his ravenous maw with food. Frequently, too, on tempestuous nights, when the wind and the sea seem to howl a funeral dirge, the shark appears in the midst of the heaving billows; the seamen recognize his presence by the phosphorescence—the “elfish light”—

The flash of golden fire—

that glints from his shining scales, and know that he lusts after a victim. In tropical waters he follows the ships with indefatigable patience, ready to swallow the unfortunate who may fall overboard, or the dead mariner whose body is committed to the deep as to a last resting-place. For this voracious creature the dead and the living are equally satisfactory prey.

The “fierce joy” of a difficult and even dangerous struggle, the intense gratification of conquering a great destroyer, would be sufficient motives to animate the sailor in hunting the shark; but, besides, several useful products are obtained from the monster. His thick, hard skin, susceptible of a fine polish, is employed for sheaths and cases. His liver yields an oil identical in its properties with that of the cod’s liver, and ca-

pable of being applied to the dressing of skins. His flesh is leathery, it is true, but eatable in extremities.

We borrow from an eye-witness the story of the capture of one of these destructive yet not wholly useless animals: A shark of great size, certainly not less than thirty-five feet in length, had ventured to draw near our vessel. As we were then becalmed, and had nothing to do, we hailed the pleasant burst of excitement, the agreeable relief to our monotonous occupations, which he was likely to afford us. By way of precaution, and to keep him occupied, we flung to him a pair of old boots, which he conscientiously swallowed. However, he as yet needed no enticement; for while the calm lasted, and so long as our ship did not make more than three or four knots per hour, the shark never stirred from the wake of our floating palace. While he amuses himself in plunging and diving in the wake of the ship, everybody is in a state of tumult upon deck. We arrange our warlike engines, and make ready for the battle. An enormous fish-hook is attached, by means of a bit of iron chain, to the extremity of a long and stout cable. The bait is a large piece of pork, just such another piece as the monster has already swallowed, while it lay soaking in the sea-water in readiness for the crew's dinner.

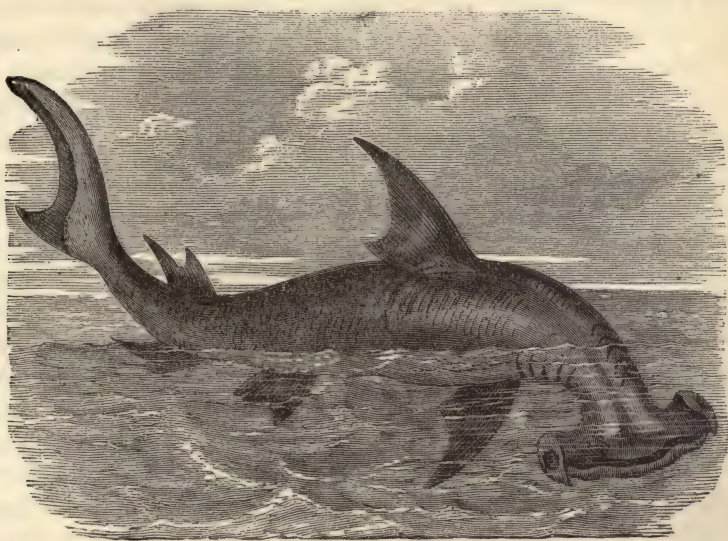
Capture of a Ferocious Shark.

At length all is ready. The captain holds in his grasp a well greased harpoon; the slip-knots of the cable glide with complete ease, and are disposed within reach of the hand. Everybody has collected on the quarter-deck. A sailor flings the hook into the sea, and the fishing begins. The shark now ceases to plunge and wheel about the ship; he smells the bait, and lazily swims towards the floating piece of pork. He has learnt long ago that so small a prey cannot escape him. Immediately that he touches it with his snout, he turns on his side, opens his huge mouth, and swallows it. But at this moment the cable is violently jerked, forcing the fish-hook into one of his jaws; two hands catch firm hold of the rope, and begin to tighten it, while the shark plunges about in wrath and pain, churning the waters into foam. Sometimes the hook breaks; in such cases the game must be recommenced. The shark, with torn and bleeding throat, nevertheless swallows a second bait with equal avidity, having been made no wiser by wounds already received.

As soon as we are satisfied that the hook is securely fixed, we draw the animal alongside. The man placed at the post of honor, generally, as in the present case, the captain, vigorously darts the harpoon into his body. It is necessary that the iron should so far penetrate into the flesh that the movable portion form a cross with the axis of the lance. We have then

two points of attachment, and raise the shark out of the water by means of the cable of the fish-hook and the rope of the harpoon, drawing upon both simultaneously. The animal once lifted from the sea, loses a part of his strength; his fins and tail have no longer any point of support. Nothing is easier, while he hangs by the ship's side, than to pass a slip-knot round his tail. The three ropes which now hold him fast run quickly over pulleys fixed to the yard-arms, and the shark is speedily landed on the quarter-deck.

The prisoner is captured, and his punishment not long delayed. In vain are all his struggles; in vain the repeated and heavy blows of his tail, which threaten to crush through the planks. A sailor plunges a



THE HAMMER-HEADED SHARK.

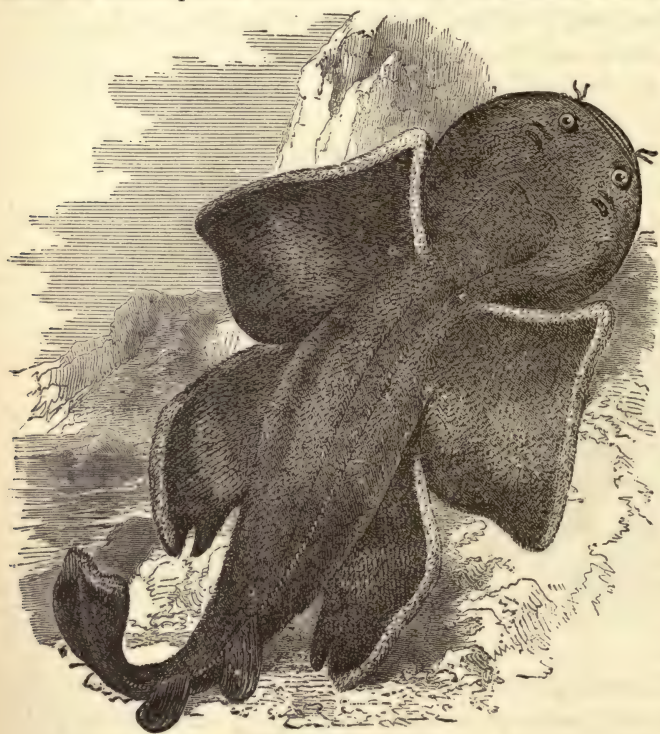
hand-spike into his throat, to hold him down, while another severs his tail with an axe. In this mutilated condition he is completely harmless and powerless; though a blow from his tail would kill a man, or, at all events, break his thigh. The monster rendered defenceless, we cut it open and extract the heart, which is immediately flung overboard. Sometimes a portion of the stomach is put aside to be eaten; sometimes the animal is stripped of his skin, which is dried, while the dorsal spine is fashioned into a handsome walking-stick. The liver, also, will probably be utilized, being rich in iodized oil.

One species of shark is called the hammer-headed. It has a head dilated on each side to so great an extent as to resemble some colossal ham-

mer; such an one, for instance, as may have been wielded by the hand of Thor. The eyes, which are very large, are placed at each extremity; the mouth beneath, as in others of its tribe. It is a native of the Mediterranean and Indian Seas; no less formidable from its voracity, than frightful from its hideousness. It also frequents the blue waters of the Polynesian Islands. Its usual length is nine or ten feet.

The angel fish, or monk-fish, however, surpasses the former in ugliness, and one could almost believe its creation to have been a freak of nature in some distempered dream. It owes its name to the popular wit which

sees an admirable jest in the name of the creature, contradicting its appearance. Or we may ascribe it to the shape and position of its extended fins, which may be taken to represent wings; just as the name of monk-fish refers to its rounded head, which seems enveloped in a hood. Very large is this head, with wide mouth, and small eyes; behind each an

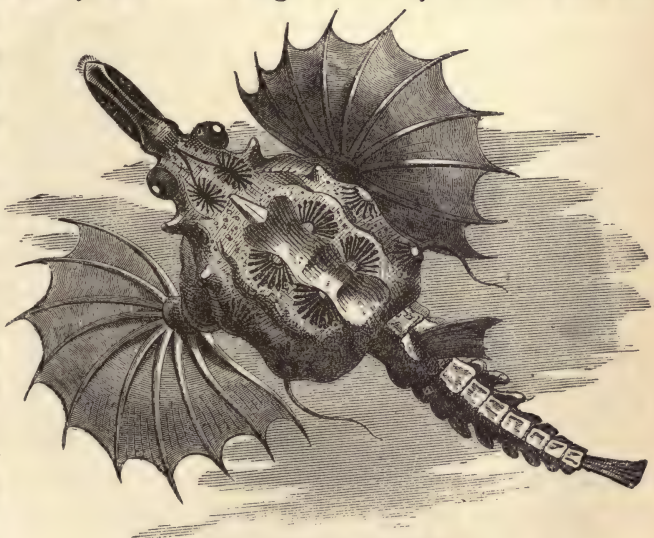


THE ANGEL FISH.

orifice in the shape of a crescent;—the whole resembling one of those grotesque masks which a country boy sometimes forms out of a hollow pumpkin. The back is of a pale ash color, and extremely rough, with a prickly line marking the centre. The belly is white and smooth; the pectoral fins are large; the ventral fins are also horizontally extended. It is satisfactory to add that the animal's ugliness by no means belies its disposition; it is exceedingly fierce, voracious, and dangerous to approach. It sometimes attains the length of seven or eight feet, and the weight of a hundred pounds.

If the seaman's imagination could convert the heavy unwieldy fins of the angel-fish into supposed wings, it would certainly effect a similar transformation, and with much greater ease, for the fins of the so-called flying-fish. Fishes of this genus are enabled to spring from the water at intervals, and to maintain a brief temporary flight in the air, through the extraordinary size of their membranous fins. They undertake those aerial escapades for the purpose of escaping from the jaws of the dolphin and other fishes which pursue them, but in avoiding one danger they frequently fall into another, and become the prey of the large aquatic birds. The greatest length of time they can keep on the wing appears to be about half a minute, and their longest flight 220 to 250 yards, while, when hard pressed, they will rise as high as twenty feet. It must not

be supposed that they have the power of elevating themselves in the air after having left their native element; for, on watching them, they have often been seen to fall much below the elevation at which they originally rose from the water, but never in any one instance, have they been



THE PEGASUS DRAGON.

observed to rise from the height at which they first sprang; the elevation they first take depends on the power of the first spring or leap they make on leaving their native element. The flying-fish, in the tropical seas, may be seen rising from the water in countless shoals, when pursued by a foe or disturbed by a passing ship. They leap from the glancing crest of a wave, and, sweeping forward, dive into another, to wet the membrane of their fins, and in this manner continue their flights for a considerable distance. Several species are found in the Mediterranean, and the Indian and American seas.

The most extraordinary genus is that of the pegasus, or flying horse. They have a snout, with a mouth beneath it, and movable, like that of a stur-

geon; the fins are large, and are four in number. The dragon pegasus is curiously constructed; its body, broad and flattened, is armed with several radiated shields or bony bunches; the diameter of the lower part of the body suddenly decreases; the tail is small and slightly rounded; and the whole posterior portion of this ungainly fish may be compared to that of a crocodile. It indubitably belongs to the same family as the sea-horse, pipe-fish. It has a tubular jaw, and a short, deep, compressed body, invested in scales as in a kind of armor. The males have pouches on their tails, in which the eggs are carried until hatched. They swim in a vertical position, with the tail prepared to grasp any object it may encounter; the horses with which Posidon, if you like, drives his chariot through the coral halls of the deep!

A Hideous Inhabitant of the Sea.

If it is true that most marine shells, in the exquisite gracefulness of their design and the intense glow of their coloring defy description or imitation, and compel the admiration of the most indifferent, it is equally certain, on the other hand, that the world of fishes offers a variety of unshapely types and of repulsive and hideously grotesque physiognomies, which must equally be the despair of the author and the artist, while exciting a sense of loathing in every mind. Similar shapes could only exist in the disordered imagination of some fanciful painter, or some lunatic poet! And Boileau has proved his ignorance of ichthyology by his assertion that—

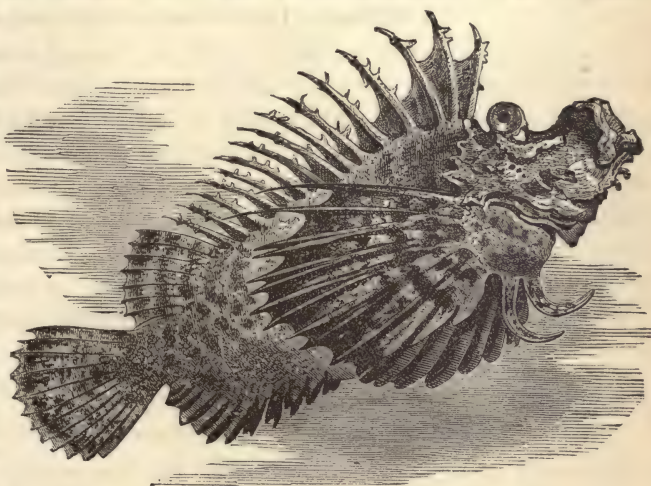
No serpent is there, and no monster vile,
Which, imitated by the artist's toil,
Shall not the well-pleased eye of Taste beguile.

Assuredly he could never have seen the hippocampus, the angel-fish, the pegasus, or, transcendant in its ugliness, the stomias-boa, which finds a vigorous competitor, however, in the spike fish. The least ungainly and repellent, those which delight the well-pleased eye by their slender, shapely body—their scales shining with gleams of silver, pearl, or azure—do not compensate by these advantages for the disgusting character of the most essential part in the entire body—the head. But they win the admiration of the philosopher, nevertheless, by their admirable adaptation to the peculiar medium they inhabit; by that perfect branchial apparatus which enables them to extract for breathing purposes, the air held in solution in the water: it is the fins, so admirably arranged for the co-ordination of all its movements; it is its powerful muscles, its strong and supple body; and it is that peculiar organ which, filling with air or emptying at the animal's will, augments or increases its specific lightness, and causes it to

rise or sink with extreme facility: in a word, the fish is, *par excellence*, the aquatic animal. And it has, like all God's creatures, its own perfection, and a beauty of its own, resulting from that perfection.

To sum up, this true son of the water, as mobile as its mother, glides through it by means of its mucus, cleaves the waves with its head, clashes them with its muscles; in fine, with its strong fins it cuts, it rows, it steers. The smallest of these powers would suffice. The fish, uniting them all, is the absolute type of movement. For this reason one delights to watch it swimming, as one delights to watch a bird flying; one sees so clearly that it is in its own element! And therefore people say, naïvely but justly, "As happy as a fish in the water." As for its means of attack or defence, they are worth but little. The monster

sharks—such as the white shark and the sword-fish—are almost the only ones actually equipped for combat; the first with its terrible movable arsenal of teeth, the second with its keen, heavy, and jagged sword. Other species are also provided with a kind of beak,



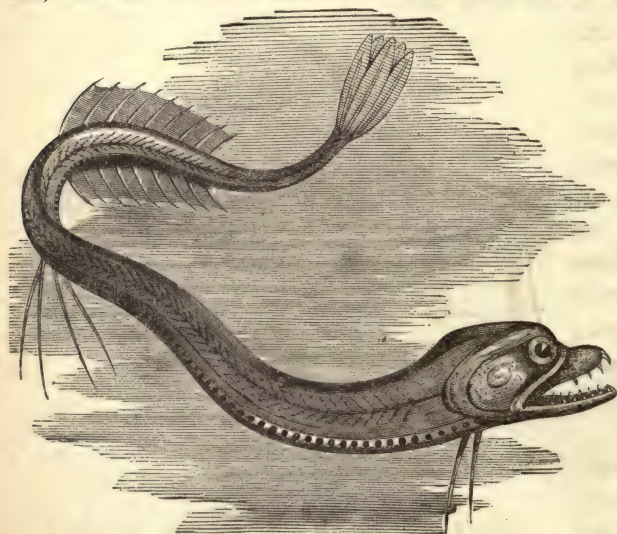
THE SPIKE FISH.

formed by the horizontal extension of the bones of the head, which has led to their being designated in all languages, ancient and modern, by the expressive name of sword-fish. But it does not appear that either their bony lance, or the great dimensions of these fishes, which frequently attain the length of ten to thirteen feet, renders them very formidable. Their manners are inoffensive, nay, even sociable; and it is most often by accident, or when exasperated that they drive their weapon into the ship's keel, or into other inert bodies, and by so doing snap it off.

Professor Silliman's name is well known as that of an American savant who delighted in making the public acquainted with the novelties that came under his observation, and with the discoveries of science. The accompanying engraving represents a double cat-fish that was pre-

sented to the professor a few years ago. It was taken alive in a shrimp-net at the mouth of Cape Fear River, near Fort Johnson, North Carolina. The two fishes were joined much in the same manner as the Siamese twins, by a piece of skin on the breast, the point of union being marked by a dark streak, otherwise the appearance of the skin was not found to differ from that of the fish's belly. There was no connection between the viscera of the fishes, but the integument was hollow or double, so that when an incision was made in one of the fishes and the entrails taken out, a flexible probe could be passed through into the body of the other. The integument was thin and very flexible, so that the two fishes could almost swim together in the natural

position at the same time. The difference in the size of the two fishes is worth remarking. It is quite evident that the larger one must have got the start of the other in the race of life, and that it continued to appropriate the lion's share of the good things which fell to their joint lot. The little fish, indeed, must have shown some dexterity to live at



THE STOMIAS-BOA.

all, and surely deserved infinite credit as a "snapper up of unconsidered trifles."

The lowest of all, in the tribe of fishes, has rather an ugly name. It is more like a worm than a fish; and Linnæus, the famous naturalist did class it with the worms. It has been examined with great care, and is found to be a relation of the lamprey. It has really no skeleton at all. A bare tube, or thread, of gristle runs through the body, and when boiled the whole tube goes to jelly. It has no eyes, and you would suppose it to be the most defenceless of its tribe; but it is a very unpleasant neighbor, and is quite able to take care of itself. Blind though it is, it contrives to get inside some other fish. How it can do so is not clearly known, but a fish has been found completely devoured, the skin only

remaining, and the glutinous hag within it. The hag has eight feelers around its mouth; they have a very acute sense of touch. As the fingers of a blind man can almost do the work of eyes, so these feelers guide the blind fish, and help it to find its food. On the palate there is a single tooth like a hook. The fish hooks on to its prey, and is thought by some naturalists to make a hole for itself to get in. It keeps hold until the two rows of teeth that are upon the tongue can come into play. It eats with its head buried in the fish it is devouring, so that Nature has made the same provision that she has in the case of the lamprey. The breathing holes of this disagreeable creature are placed so far back that it can eat and breathe at the same time.

It is called the glutinous hag because there are pores down each side of its body that give out a glutinous matter. When the creature is attacked it can throw out a quantity of this slimy secretion, and hide itself in it. It is sometimes called the borer, because it bores or pierces into its weaker neighbors.



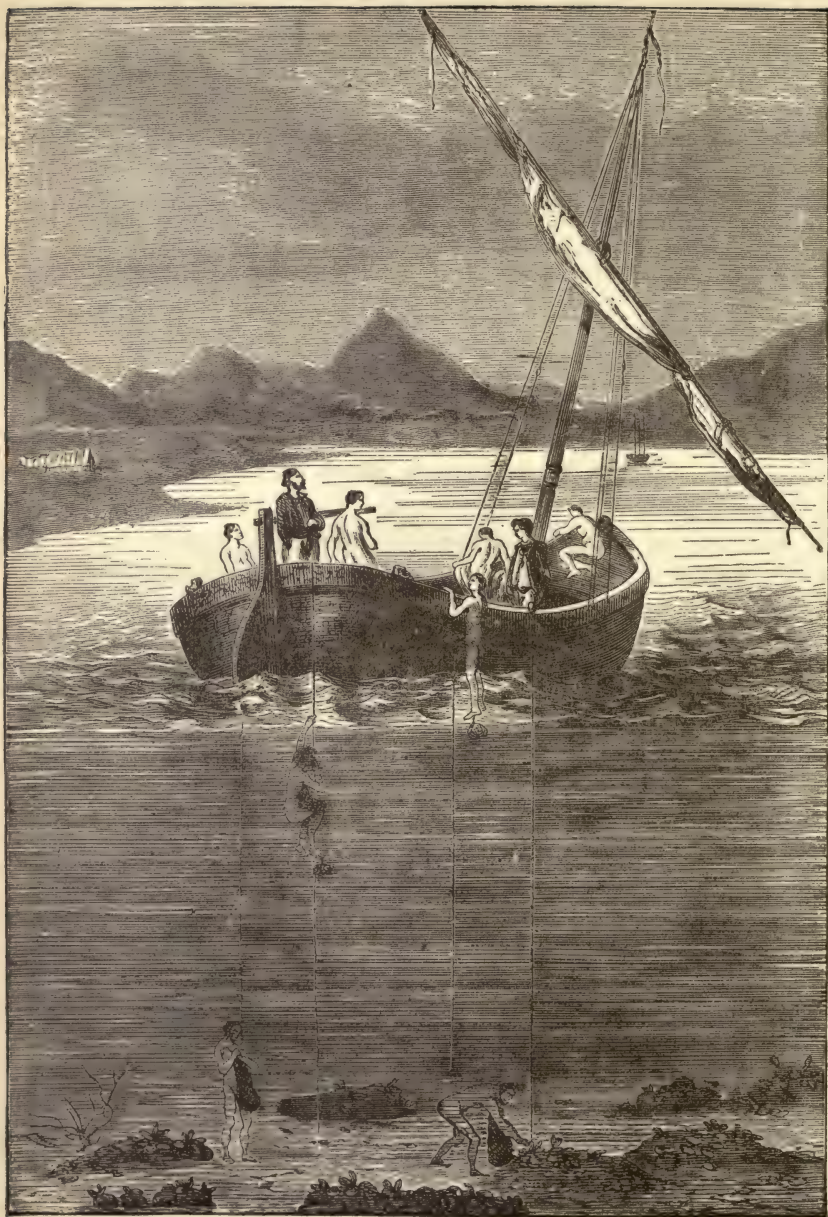
We have been speaking of some of the monsters of the great deep,

PROFESSOR SILLIMAN'S DOUBLE CAT-FISH.

but the sea itself is really the great, unparalleled monster of the globe.

Wedges of gold, great anchors, heaps of gold,
Inestimable stones, unvalued jewels,
All scattered in the bottom of the sea.

Ocean conceals under its mass of waters, at variable depths, divers substances which have appeared to man peculiarly worthy of his covetousness. None assuredly are comparable in utility to the flesh of fish, the fat of the cetaceans or amphibians; but we are so made that, under a pretence of civilization and progress, we estimate things in an inverse ratio to the services they render us; we value as most precious those of which we have the least need, and no sacrifice to obtain them appears too great for us. We scorn or waste the true treasures which a bountiful Providence has placed liberally and lavishly within our reach, and we suf-



PROFESSIONAL DIVERS GATHERING SPONGE.

fer poor wretches to dare death, and endure all kinds of fatigue and privation in procuring for us some gaily-colored gewgaws or glittering toys, which, far from adding to our happiness, do but divert us from the search after that which is really desirable.

Not content, then, with penetrating into the bowels of the earth to secure those shining, gleaming stones which we dignify as "precious," we must also pierce beneath the liquid element to snatch from the ocean-bed those intrinsically valueless products, with which it is so easy to dispense, and with which, in effect, millions of persons do dispense, and yet find themselves neither the poorer nor the less happy. The reader will surmise that we are referring to mother-of-pearl, pearls, and coral. There is a fourth submarine product which merits a greater degree of indulgence, and even whose utility we cannot wholly ignore, while questioning whether this utility is really proportionate to the efforts of obtaining it.

A Business that Shortens Life.

There is no work, however painful or homicidal it may be, for which we shall not find the men. Thousands consent to bury themselves alive in the dark, hot, stifling galleries of mines sunk hundreds of fathoms deep, to explore the veins of coal or the metalliferous strata. Others make no difficulty of descending beneath the waves, for the purpose of collecting on rock or sand the sponge, the fantastic coralline spar, the mother-of-pearl shells. These miners of ocean are known by the name of divers. The incessant repetition of a violent and unwholesome exercise, terrible dangers, maladies which they contract almost infallibly, and which to a greater or less extent abridge their days,—such are the sacrifices, the martyrdom, by which these poor wretches earn their scanty pay. This they call "gaining a livelihood," and the majority of them voluntarily adopt this amphibious existence, so antagonistic to the physical organization of man! It should be remarked, nevertheless, that the diver's profession is not one of those which the first-comer consents to embrace. It has long remained the occupation of certain populations, among whom it is generally hereditary, and who are gradually inured to it by the force of habit, by the difficulty of finding any other employment of their strength and faculties, and by the modifications which an abnormal kind of life slowly effects in the temperament and physiological functions. It is thus that the sponge-fishery is exclusively practised by the Greeks and Syrians; that of coral by the Genoese and Neapolitans; that of pearls and mother-of-pearl, in Asia by the Cingalese and Malays, in South America by the Indians and negroes.

Sponges were formerly caught in the Red Sea and along a great part

of the north coast of Africa. At present, the fishery is principally pursued in the Greek Archipelago, and on the Syrian shores. It is open to all nations; but the Greeks and Syrians alone follow it up as a regular trade, and make its products the staple of a regular commerce with the West. Operations ordinarily begin early in June and terminate in October; but the least favorable months are those of July and August. Each boat usually carries four or six men. The sponges are found at a distance of 1000 to 2000 yards out at sea, on banks of rocks formed by molluscous *débris*. The finest specimens lie at a depth of twelve to twenty fathoms; those collected in shallower waters are of inferior quality.

Marvelous Exploits of Sponge-Divers.

At the opening of the fishery, the Greeks and Syrians arrive at Smyrna, Beyroot, Latakia, and Rhodes in large shallops, which they dismantle in order to equip the small craft suitable for their operations, and then disperse along the coasts. The fishery is conducted in two ways. For the common kinds they employ three-toothed harpoons, by means of which they catch hold of the sponges. But this implement would injure the finer species; and in quest of these skilful divers descend to the bottom of the sea, and carefully detach them with a strong knife. Hence the difference of price between the divers' sponges and the harpooned sponges.

The Greek divers are, as a rule, bolder and more skilful than the Syrians. Those of Kalminos and Psora are the most renowned. While they can remain in the water longer than the Syrians, their fishing is generally more abundant. They dive to a depth of twenty fathoms, while their rivals, for the most part, cannot descend beyond fifteen or twenty fathoms at the utmost. The Greeks devote themselves more particularly to the fishing of the large sponges called "venetian," although they sell them by weight four or five times cheaper than the fine sponges; but the inferiority in price is balanced by the much greater facility of the fishing. Importers have introduced into European commerce, within the last few years, a species of sponge collected on the coasts of the Lucayos Islands, in the Caribbean Sea, which is known as the Bahama sponge. It is of a peculiarly attractive appearance, thanks to its fine close tissue, and to the preparations which it undergoes in order to give it a beautiful pale blonde tinge; but it is hard, strong, and without solidity.



CHAPTER II.

MYSTERIES OF THE OCEAN.

Chinese Belief Respecting the Deluge—The Great Mexican Inundation—A Huge Gulf Swallowing Rivers—The World would be Dead Without the Ocean—The Race—Course of Commerce—Varied Color of the Sea—Causes of the Different Tints—Countless Myriads of Animalcules—Phosphorescence of the Sea—Waves Silvered with Flashing Light—A Magical Effect—Cyclones and Tempests—Strange Story of a Lost Vessel—Terrible Fury of Ocean Storms—The Dreaded Water Spout—Ships Lifted Bodily from the Sea and Hurled Back—The Mysterious Argonaut—A Creature that Sails in a Boat—The Monstrous Octopus—An Ink-Battery—A Shot that Hit—Dreadful Encounter with a Cuttle-Fish—A Pearl-Diver Attacked—Nautilus of the Pre-Historic Seas.

CONFUCIUS, the Chinese philosopher and law-giver, born more than five centuries before Christ, begins his history of China by speaking of the Emperor named Jas, whom he represents as making the waters flow back, which then raised themselves to the heavens, while they bathed the foot of the highest mountains, covering the smaller hills and inundating the plains. This statement is not only from an authority of high repute, but is especially interesting as showing a belief in an early deluge among the people of the "Flowery Kingdom." Traditions of this are everywhere found in the East, and such evidences from marine shells and the formation of the earth's surface as must be considered more conclusive than tradition.

A deluge of quite moderate date conveys a tolerably exact idea of the phenomena which must have been exhibited in the early time, and we recall the circumstances as assisting us to comprehend the true nature of the ravages the deluge inflicted upon Asia in that ancient period. At six days' journey from the city of Mexico, there existed, in 1759, a fertile and well-cultivated district, where abundance of rice, maize and bananas grew. In the month of June frightful earthquakes disturbed the soil, and were continued unceasingly during two whole months. On the night of the 28th of September the earth was violently convulsed, and a region of many leagues in extent was slowly raised until it attained a height of about 500 feet, forming a plateau many leagues square. The earth undulated like the waves of the sea in a tempest; thousands of small hills rose and disappeared in turn, and, finally, an immense gulf opened, from which smoke, fire, red-hot stones and ashes

were violently discharged, and darted to prodigious heights. Six mountains surged up from the gaping gulf; among which the volcanic mountain of Jorullo, which rises 2150 feet above the ancient plain, is the most prominent.

At the moment when the earthquake commenced the two rivers of Cuitimbo and San Pedro flowed backwards, inundating all the plain now occupied by Jorullo; but in the upheaving region, while it continued to rise, a gulf opened and swallowed the rivers. They reappeared to the west, but at a point very distant from their ancient bed. This inundation reminds us on a small scale of the phenomena which attended the deluge described in the Hebrew annals. That period of overwhelming disaster, an overflow which buried hills and valleys alike is past, and the sea now knows its fixed bounds, and the land has reared its bulwarks, beyond which the great floods do not pass.

The Sea a Great Fountain of Life and Health.

The ocean plays a very important part in the grand economy of nature. Swept by the incessant winds, its vast surface continually inspires the various gases which load the atmosphere; in its enormous mass it engulfs the débris carried down to it by the rivers and streams which have washed the continents and islands, and restores to the atmosphere, in the form of vapor, those purified waters which descend upon the earth in the shape of rain or snow, or dew. These waters again flow back into the ocean through the streams, the brooks and the rivers; and thus an eternal circle is established, an unending voyage, which makes the same waters serve for the support and renewal of the world's organic life.

The ocean by its exhalations which refresh and moisten the air, nourishes vegetable life, and furnishes the necessary aliment for those admirable channels of running water that are ever flowing, and yet never empty. But for the beneficent influence of the vapors which every moment escape from the surface of the sea, the whole earth would sicken and wither into an inanimate desert; and if the ocean slowly or suddenly dried up, all organized nature would probably be annihilated.

The World's Great Highway of Commerce.

Nevertheless, the immense and profound seas offer no obstacles to the commercial intercourse of nations, whom they only separate in appearance; the maritime highways now traversed by such long processions of ships are freer and broader than those of earth; their maintenance lays no burden upon human communities, for they are kept up by nature. One of the most remarkable features of the sea is its continuity. With the exception of some inland reservoirs which the ocean long ages ago abandoned

in the heart of the continents—such as the Dead Sea and the Caspian—it is one and indivisible. It embraces the whole earth with uninterrupted wave.

THE HISTORIC DELUGE AND ITS TERRIBLE DEVASTATION.



The color of the sea varies greatly, at least in appearance. According to the evidence of a host of observers, the ocean, when seen by reflection,

presents a tint of ultramarine blue, or lively azure. When the air is pure, the tranquil surface of the waters seems of a brighter and more radiant blue than the skies. In cloudy weather this passes into a sombre green; which becomes darkly or luridly brown when the sea is agitated. At sunset the waves are kindled with glowing hues of purple and emerald. Or, as Byron sings—

O'er the hushed deep the yellow beam he throws,
Gilds the green wave that trembles as it grows.

A variety of local circumstances also influence the color of the ocean-waters and sometimes clothe them with a marked and permanent hue. If the bottom be of white sand, and the water not very deep, its tint will be grayish or apple-green; if the sand be yellow, the green is deepened and darkened. The neighborhood of reefs is frequently indicated by the "pronounced color," of the surrounding sea. In the Bay of Loango the waters seem of a burning red, because such is the natural color of its bed.

At other times a peculiar tint is given to the waters by colored animalcules. The Red Sea owes its coloring to a microscopic alga. The sea-waters—condensed by the spontaneous action of the solar rays—in the salt-marshes of Southern France assume, when they have arrived at a certain stage of condensation, a beautiful red color, which is owing to some animalcules with a reddish shell that live in sea-water under this condition, and die (a strange and curious fact!) as soon as the water becomes more highly condensed, or is diluted by the effect of rain. Navigators frequently traverse long green, red, white, or yellow belts of water, whose tints are derived from certain microscopic crustacea, medusas, zoophytes, and marine plants. Such is the case with the "Sargasso Sea" of the Atlantic, which lies midway between the Azores, the Canaries, and the Cape de Verde islands, occupying a space equal in extent to the whole valley of the Mississippi. Another Sargasso Sea is found in the Indian Ocean; and a third just outside the Antarctic Circle.

The Light of the Ocean.

It is to a similar cause we must refer the magnificent phenomenon of the phosphorescence of the sea, which delights and astonishes the voyager in the Indian Ocean, the Baltic, the Arabian Gulf, and elsewhere. In the Indian Ocean, Captain Kingman traversed a zone fully twenty-four miles in width which was so full of phosphorescent animalcules as to present, at nightfall, the appearance of an immense field of snow. These animals, nearly two inches long, were formed of a transparent gelatinous matter. The reflection of the solar light upon this substance gave to the surface of the water a milky appearance.



A PHOSPHORESCENT SEA.

The phosphorescence of the sea is an imposing and magnificent spectacle. The ship, when cleaving "the liquid plain," seems to advance in the midst of golden and vermillion flames, which flash off from the keel like electric lightnings. Myriads of stars seem to float and play on the rippling tide; they multiply—they unite—they swell into one vast field of fire. The scene is one which in its fantastic and almost weird character may well remind the spectator of the sight that dazzled the Ancient Mariner, described by Coleridge :

They moved in tracks of shining white,
And when they reared, the elfish light
Fell off in hoary flakes.
Within the shadow of the ship
I watched their rich attire;
Blue, glossy green, and velvet black,
They coiled and swam; and every track
Was a flash of golden fire.

That infusoriæ should tint the sea is, undoubtedly, a marvelous phenomenon; but they do more—they brighten, they enkindle it! The phosphorescence of ocean was long a mystery, before which man's reason stood confounded, and which inspired him with mingled feelings of admiration and terror. Luminous water! The sea on fire, and yet harmless, and still preserving its cold or warm temperature! How extraordinary a mirage! How strange an anomaly! It is only in modern times that science has sought an explanation of the miracle; and this explanation, when at length obtained, reposes upon another prodigy not less astonishing than the former.

Waves Tipped With Lightning.

In our temperate climates, and in that region of the Atlantic which extends between the English and French coasts, we see the ocean phosphorescent only in summer, and in seasons of great warmth and tranquillity. Then the foam of the waves which die upon the ribbed sand, the spray which is churned up by the boatman's oar, or the steamer's paddle-wheel, the wake of the vessel, the drops which spring upwards when a stone is flung into the water—all seem composed of a luminous snow with keen steel-blue reflections. But this spectacle may not be compared with the scenes presented by the great tropical sea, hot and electric, and teeming with life. There the phenomenon occurs both in bad and fair weather. In the latter case, the waves seem to dart lightnings like a storm-cloud. Cook and several other navigators have observed the phosphorescence in these regions in misty weather and on a billowy sea.

WHALE AND FISHES IN BRILLIANT PHOSPHORESCENT LIGHT.



He who has not been a witness of this phenomenon, says Humboldt, can form but an imperfect idea of the splendors of so grand a spectacle. When a ship of war, driven by a strong breeze, ploughs the foamy waves, if one clings to the halyards, he is a witness of a scene of peculiar magnificence. Each time that in its rolling motions the vessel's broadside emerges from the waters, vermilion flames, like lightnings, seem to issue from the keel, and dart toward the liquid surface.

Vivid Jets of Flame.

Two French naturalists, who have accompanied several expeditions round the world, and traversed the ocean in every direction, have many times had occasion to admire this illumination of the waters. Scarcely has day disappeared, they say, before the scene begins, and millions of luminous bodies seem to roll in the midst of the waves. The intensity of the light increases on the sides of the ship or the rocks against which the billow breaks; each stroke of a boat-oar produces vivid flaming jets; and the swiftly-moving vessel leaves behind her a long furrow of fire, which gradually fades away as it recedes in the distance.

Ordinarily, it is through a natural or artificial perturbation of the waters that the phosphorescence becomes perceptible; but sometimes also the sea is spontaneously phosphorescent, and one discovers immense luminous tracts kindling over the liquid plain, extending, contracting, or elongating, and following all the graceful curves of its undulations. Who cannot conceive that in the days of ignorance and superstition such appearances would give rise to numerous fables? No phenomenon is better calculated to inspire man with a species of religious stupefaction. Since science has undertaken the task of penetrating the secrets of nature, of discovering the key to each of her enigmas, the phosphorescence of the ocean has lost none of its claims to our admiration, if we refuse to regard it with superstitious awe or credulous terror; and, though we have succeeded in ascertaining its cause, we are still unable to explain that cause itself.

Every Wave a Light-House.

In stormy weather the rolling billows are all lighted up, and swell and break in silver-flashing foam. Glittering bodies, which might be mistaken for fiery snakes, seem to pursue each other, to overtake each other, to disappear, and again to flash forth in living lustre!

Known from time immemorial, the phenomenon of the phosphorescence of the sea has been observed by all navigators. It is of frequent occurrence in certain regions of the ocean, especially in the Indian Sea and under the tropics. The radiance lights up the crest of the waves which,

as they fall back, scatter it abroad in every direction ; it clings also to the helm, and seems to escape from the waves tossed off the vessel's bow ; it plays also about the weedy rock and billow-beaten reef. In the still, shadowless nights of the tropic world the effect produced by this phenomenon is truly magical.

This phosphorescent lustre originates in the presence of a multitude of molluscs and zoophytes which glitter with a radiance originated by themselves. They emit a fluid so susceptible of expansion that, when swimming zigzag, they describe upon the water a series of brilliant tracks which extend with singular rapidity.

Cyclones at Sea.

We have been describing one of the milder phenomena of the ocean. There are scenes, however, of a wild and terrible description which neither pen nor imagination can adequately depict. The hurricane, properly so called, is a cyclone animated by a gyratory movement. Brande, in Germany, and Redfield, at New York, demonstrated that the tempest is generally a progressive whirlwind, which moves forward while rotating on itself. Felix Julien has ascertained the direction of the gyratory movement of cyclones from his experience of a terrible hurricane in whose centre the frigate was involved on which he was sailing.

The breeze, he says, blew from the south-east ; the sea rolled heavily. Towards evening, the barometer sank abruptly beneath the lowest limits marked on its scale. The wind as it freshened veered to the south ; it gradually increased in force, and ended by breaking loose with irresistible violence. At midnight, in spite of the most energetic exertions, the dismantled frigate, without helm, without sails, lay on her broadside, with her rigging in tatters, and her deck swept by a furious sea. It was not until two hours later that we reached the centre of the cyclone. A sudden calm succeeded the first crisis of this atmospheric convulsion, but it was of brief duration. The winds which had abandoned us in the south reappeared in the west and north with the rapidity of lightning. We entered the second segment of the circle of the storm. Caught this time on the left, our ship heeled over anew, unable to resist the enormous pressure directed against her side.

A Strange Vision.

The tempest just spoken of was distinguished by a strange and gloomy episode, by one of those scenes equally fantastic and heart-rending, which the implacable ocean reserves, with supreme irony, for the poor unfortunates whom she has overwhelmed with sorrow. The corvette which accompanied the frigate as a tender had disappeared in the *mêlée*. Having

escaped the peril, and, by means of a jury-mast, gained the appointed rendezvous at St. Mary, in the island of Madagascar, the seamen of the frigate explored in vain all the creeks and indentations of the coast; in vain they daily surveyed the horizon in every quarter, hopeful that the corvette, only driven from her route by the tempest, would return into port.

A month passed by, a month of deep anxiety, and expectation had at length given place to the most poignant regret, when one morning the look-out man signalled in the west a dismasted vessel driving towards the shore. It was not a dream, says Julien; the sun was glowing, the sky limpid and unstained. The warm air trembled on the horizon. Every telescope, pointed in that direction, confirmed the exactness of the first intimation. But our emotion soon became more profound. It was no longer a ship adrift which appeared to us, but a raft loaded with men, and towed by boats from which signals of distress were waving. The images, moreover, were clear and sharply defined; the lines perfectly distinct. On board the frigate, captain, officers, sailors, all, for several hours, were a prey to a feverish hallucination, and followed with eagerly wistful eyes the details of this indescribable ocean-scene. Admiral Desfossés, then in command on the Indian station, despatched in all haste the first steamer which arrived in the roads to the assistance of those living wrecks that the ocean seemed to restore to us from the depth of its abysses.

The Delusion Dissipated.

The day began to sink; night, as is the case in tropical climes, was already gathering over the sea without any interval of twilight, when the *Archimèdes* arrived at the end of her mission. She checked her course in the midst of floating spars, and lowered her boats. All around, her crew continued to descry masses of men in a tumult of agitation, stretching their hands to heaven in hopeless entreaty; they could hear the dull confused murmur of a great number of voices blended with the strokes of oars in the water. A few seconds more, and they would clasp in their arms their brothers snatched from the very jaws of death!

Dreams of the night, delusions vain,
Why sport ye with the anxious brain?

The boats plunged into the midst of thick branches of trees torn away from the neighboring shores and drifting with all their foliage in the counter-currents which remount to the north. Thus the strange vision vanished. Thus was dissipated the last hope which a deceitful mirage had, as it were, evoked from the depth of ocean. Thus foundered anew

under our eyes the unfortunate corvette with the three hundred victims which she had on board!

Deceived by the resemblance of certain effects, several authors confound the cyclones with the wind-spouts, and indifferently make use of one or the other word to designate the rotating tempests, the whirlwinds, to which the first alone can correctly be applied.

Appalling Fury of the Tempest.

Their ordinary form, says the eloquent Michelet, is that of a funnel. A seaman overtaken by one said to me: "I saw myself, as it were, at the bottom of a crater of an enormous volcano; around me, nothing but darkness; above, an aperture and a gleam of light." This is technically called the eye of the storm. Once involved in it, there is no hope of drawing back; it holds you in its grasp. Savage roarings, plaintive howlings, rattling and shrieks of the drowned, the groans of the unfortunate vessel which, having sprung to life again as in her own forest, bewails her approaching end, all this appalling tumult does not prevent you from hearing the shrill hissings of serpents in the shrouds and rigging. Suddenly, silence! The nucleus of the wind-spout then passes afar in a burst of horrible thunder, which deafens and almost blinds you. You recover yourself. It has rent and split the masts, and not a sound was heard!

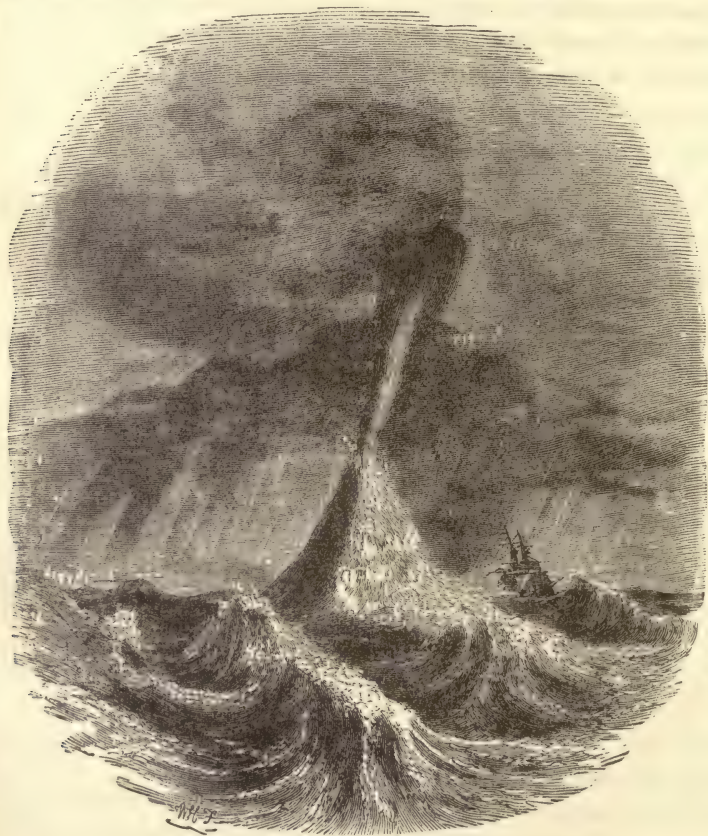
The crew are frequently afflicted for a long time afterwards with weakened eyesight and blackened finger-nails. They remember with horror that at the moment of the passage of the wind-spout, as it drew upwards the water, it also seemed to suck in the ship, and hold her suspended in the air and above the sea; then letting her go, it plunged her down again into the abyss.

In this impressive picture—a masterpiece of description—we recognize the cyclone or wind-spout. The water-spout, properly so called, sometimes accompanies the cyclone; but it is also produced independently of that phenomenon, and appears due to a violent disturbance of equilibrium in the electric condition of the atmosphere. Of all storm-phenomena, it is assuredly the most curious to observe, and the most terrible in its effects.

The Most Curious Scene in Nature.

It consists of a very dense cloud, surcharged with the electric fluid, and animated by irregular movement of extraordinary rapidity. This cloud nearly always assumes the shape of a cone reversed. Its color is a deep gray, its aspect frightful, and no less so are the symptoms which frequently precede it. The sky lowers; the day grows dark; the sun's

light becomes sickly and yellowish, the air a prey to violent agitation; the hurricane sweeps over the fields or the waves with ominous whistlings, accompanied by a dull hoarse murmur; it seems as if a volcano boiled and seethed in the entrails of the earth; then breaks the water-spout. Flashes of lightning and bursts of thunder swiftly succeed each other; the hail falls, or rather hovers, with a perpetual crash. But these are only accessory phenomena. The most appalling circumstance is the



A WATER-SPOUT AT SEA.

jet black cloud which stretches from above or below, making a void below and around it, and attracting, by the force of the fluid with which it is loaded, trees, which it withers, wrenches, and uproots; houses, which, in the twinkling of an eye, it shatters into ruins; men and animals, whom it carries off and dashes, stunned and bleeding, against the ground, at enormous distances.

Between the terrestrial and the marine water-spout there is only a difference of effects, which naturally vary, according as the meteor encounters on its passage the firm earth and solid bodies, or an extensive mass of deep waters. The action of the water-spout on the sea cannot be better compared than to a kind of suction. Immediately beneath the extremity of the cloudy cone is formed, on the surface of the waves, a symmetrical cone, which rises so much higher, and whose base is so much larger in proportion as the volume of the water-spout is greater, and its electric force more considerable. At the same time, the sea rises in the distance; bottomless precipices, white with "wrathful foam," excavate themselves around the liquid mountain; the waves hustle and roll one upon another,



A SHIP IN DANGER FROM WATER-SPOUTS.

with a roar which mingles with the rolling thunder. Woe to the ship which finds herself, not alone in the track of the scourge—in such a case she is lost, without hope!—but even at a short distance from the line which it traverses. She also is drawn within its influence, dragged thither without possible resistance. Her masts are swept by the board, the violence of the wind rends her sails to fragments; she no longer obeys her helm; she must follow the meteor. Sometimes the vessel is literally raised above the waves, then flung back into the abyss, and then engulfed, far from all human aid. Yet it is a curious fact that the seaman is not always defenceless against his formidable enemy. Authorities not unworthy of credit af-

firm that the discharge of a cannon, aimed directly at the flank of this mountain of water, cuts it into two parts. The lower sinks back again into the bosom of the sea; the upper trunk is carried away by the cloud, and at some short distance redescends in rain. But it is difficult for ships to take up such a position that they can bring their broadsides to bear on the spout, without approaching so near as to fall within its influence.

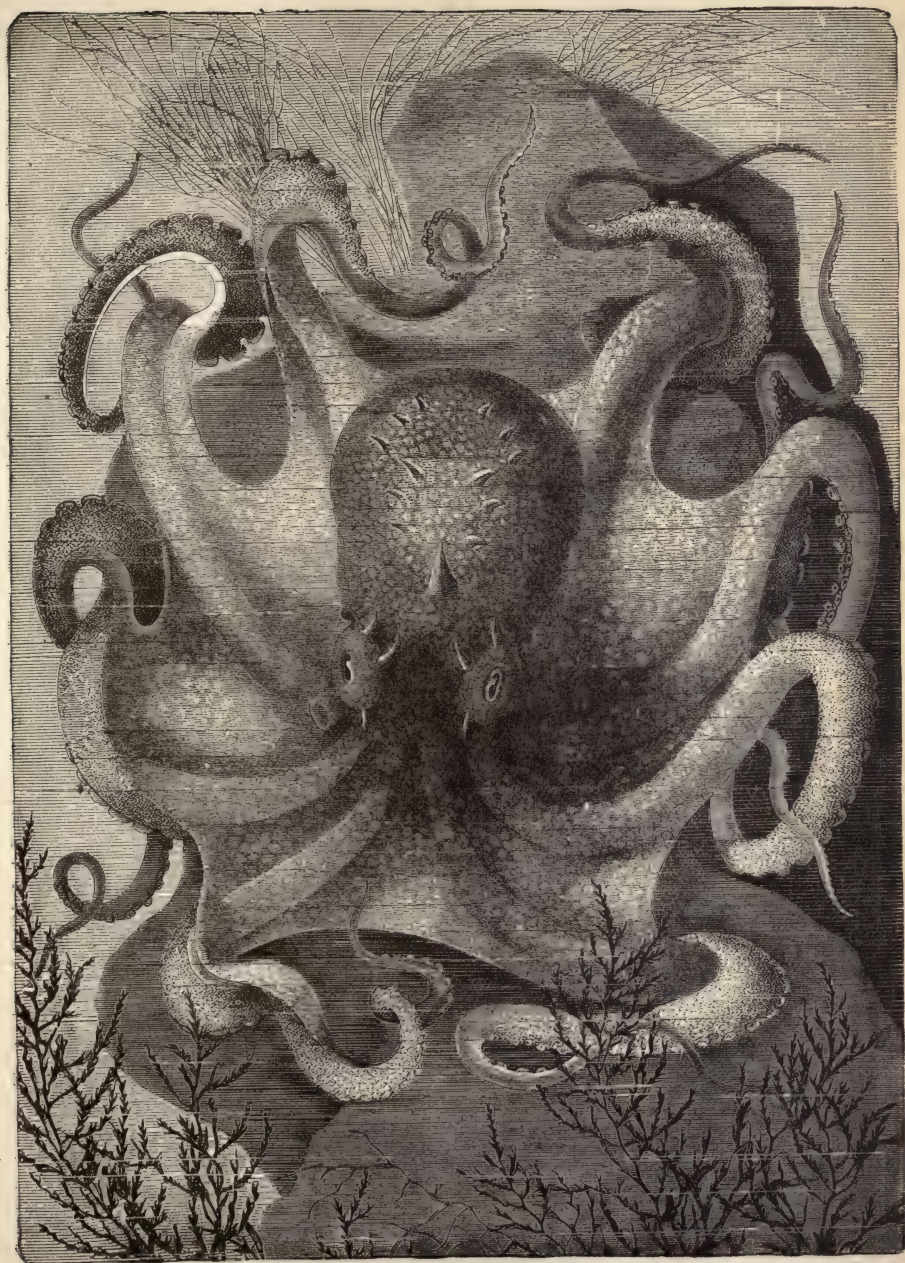
The water-spout dissipates like ordinary storms, when the electric equilibrium is re-established in the atmosphere. Fortunately, it is of rare occurrence, even in the tropics, where it may frequently traverse a wide area without encountering a single vessel. Falconer's description of this phenomenon may here appropriately be given.

Now on the larboard quarter they descry
A liquid column towering shoot on high;
The foaming base the angry whirlwinds sweep,
Where curling billows rouse the fearful deep:
Still round and round the fluid vortex flies,
Diffusing briny vapors o'er the skies.
The guns were primed; the vessel northward veers,
Till her black battery on the column bears:
The nitre fired; and, while the dreadful sound
Convulsive shook the slumbering air around,
The watery volume, trembling to the sky,
Burst down, a dreadful deluge, from on high!
The expanding ocean trembled as it fell,
And felt with swift recoil her surges swell;
But soon, this transient undulation o'er,
The sea subsides, the whirlwinds rage no more.

Not alone in tempests, water-spouts, and flaming phosphorescent light do we discover the wonders of the great deep; there are creatures which make the unexplored depths their habitation, whose singular construction and habits will never cease to excite our interest and surprise.

A Mysterious Inhabitant of the Sea.

The paper nautilus, or argonaut, has been for ages a marvel to the naturalist, and even the ancients gave graphic descriptions of it in both prose and poetry. It is a kind of poulpe or cuttle-fish, without any internal skeleton; it has eight arms, provided with suckers; two of them are expanded into broad membraneous webs, with which the animal grasps its shell when it is swimming, and by means of which it forms and secretes its shell. This is deeply grooved, and is very thin, transparent, and so flexible when wet that the sides may be pressed together. The form is exceedingly beautiful, being somewhat boat-shaped, and the creature floats in it in such a manner that some authors have supposed the art of



FRONT VIEW OF AN IMMENSE OCTOPUS.

navigation was derived from it. When the creature sinks to the bottom it crawls upon its legs, carrying its house on its back, like a snail.

It has been discovered that if the shell be broken, the animal will set to work with its two hands or trowels to mend it; that it will not only close up cracks, but supply parts that are broken away, with the same material as that which composed the original fabric. In repairing its shell it will even take advantage of pieces of shell that come in its way, and solder them in to fill up a crevice. It appears that the animal is extremely sensitive, and sometimes in fright it becomes separated from the shell, and consequently dies; it however occasionally quits its tenement voluntarily, and again resumes it. When in its shell there is a considerable vacuum at the bottom.

We are indebted for some careful and curious observations on this interesting species to Madame Power, who resided at Messina, and for several years devoted herself to the study of these animals. In order to determine whether the shells really were produced by these creatures, she placed twenty-six of them in a vessel and broke the shells in different ways. She had the satisfaction of seeing them immediately proceed to cover the broken parts with the sails, and by wrinkling them upon the parts, close the fractures. The first day the new substance was thin and delicate as a cobweb, but it thickened and hardened gradually, until in about thirteen days it had become perfectly firm, and shelly as the unwounded part, though somewhat more opaque.

The Ink-Bottle of the Ocean.

The argonaut is a native of various seas, but it is most common in the Mediterranean, and especially in the vicinity of Messina; here it is found, even in the port, all the year, but is most abundant in autumn, and in the muddy parts of the bay, where the boats lie thickest. When on the surface, if they observe any person, they fold the sail-arms over the shell, dispose the rowing arms within it, and sink. If they happen to be beneath, when alarmed, they eject their ink, to gain time to hide themselves in the mud. Those in the cages of Madame Power, after the ink-bag was emptied, would, if still pursued, spirt water from the funnel, then shrink within the shell, covered with the sails. When calm and quiet, and unconscious of being observed, they would exhibit their many beauties, rowing along with their arms, their full sails tinged with elegant colors, resting their extremities on the two sides of the shell, or embracing it with them. When pressed by hunger they would come almost to the surface, and when Madame Power offered them food, they would snatch it out of her hands and greedily devour it.



GLUTINOUS JELLY-FISHES.

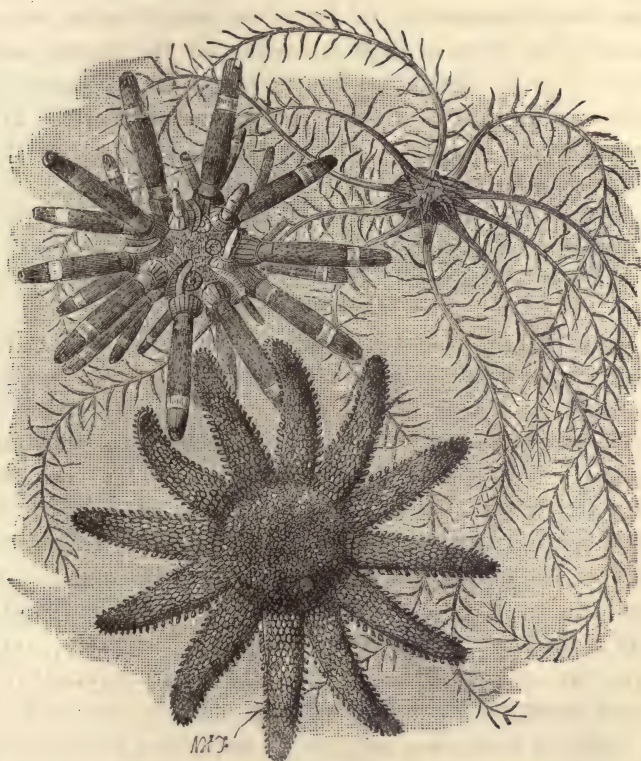
The eggs are like millet-seeds, perfectly transparent, attached by filaments of brilliant gluten to a common stem of the same. Three days after the eggs had been discovered, the little poulpes were observed in the shell of the parent, without any shell, like small worms. Soon after they began to show buds with two rows of points on them, the rudiments of the arms and suckers; the sail arms appeared first by several days. On the sixth day the first vestige of a shell was seen, very thin and flexible. The eggs are found in the interior of the spire of the parent, the young between the roof of the spire and the mantle; the infant shell seems to be first deposited in the end of its parent's spire, whose form it thus assumes; but after a while it carries on the process without aid. Two or three eggs are developed at a time; when the young are about three-quarters of an inch in length, they inclose themselves in the spire of the parent, where they remain four days to acquire the shell; three days more they remain under the body of the old one, and are then ejected. It is a very curious fact that all the argonauts hitherto found are females, whence it is supposed that the males are of a different form, and without shells.

The Hideous Octopus.

Four species of argonaut are known, all, however, closely resembling this which we have described: they inhabit the open sea throughout the warm parts of the globe. This includes the eight-armed cuttle-fish, anciently called *polypus*, which has been abbreviated into the popular title of poulpe. It has no shell, and no skeleton, but has two conical pieces of horny substances imbedded in the back, one on each side. The body, which has a globular form, is a soft, jelly-like substance, covered with a thick, dark-colored, leathery skin. The arms or legs are eight in number, and are many feet in length. The animal moves with its head either up or down; when it walks on the ground or on the bottom of the sea, it is in the latter position. The arms are each furnished with one hundred and twenty pairs of sucking-cups, making nearly two thousand in all; by means of these they are able to maintain a powerful grasp upon their prey; indeed the arms may sooner be wrenched off than forced to loose their hold. If, however, they are thus torn asunder, they are soon replaced by spontaneous growth. The arms of this species are esteemed good food by some of the people around the Mediterranean, where it is common.

The eye of the cuttle-fish is large and exceedingly keen-sighted; the whole body of the creature is phosphorescent in the dark, and the eyes shine like those of a cat. The mouth is placed in the space inclosed

by the arms; it consists of a thick circular lip around an orifice; beneath this lip, and partially appearing through the orifice is a beak like that of a parrot, excepting that the short mandible is the uppermost; these mandibles do not cover bone, but their interior is filled with a fibrous substance of great strength and solidity. The muscles in which the jaws are imbedded, and by which they are worked, are extremely powerful; the jaws are, in fact, capable of stripping off the armor from crabs and lobsters, and of cutting up the flesh of fishes. It has a strong, muscular



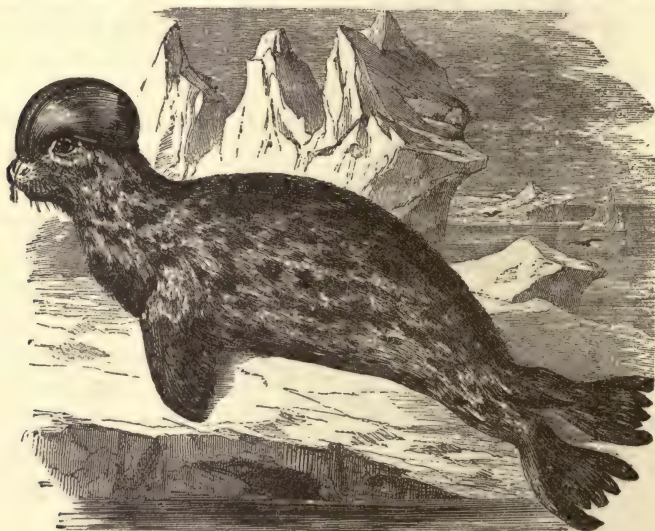
BEAUTIFUL SPECIMENS OF STAR-FISH.

gizzard, lined with a leathery skin. In this gizzard the food is ground to pulp. It may be termed the mill-hopper where the grist is ground.

In addition to its other extraordinary endowments, the cuttle-fish is supplied with an ink-bag enfolded in the mass of the liver, containing the substance called sepia, and formerly used, it is said, by the Chinese, in making Indian-ink. The creature has the power of ejecting this through its siphons placed on the left side of the abdomen, so as to ren-

der it an effectual means of defense. Powerful as it is, however, for the destruction of various kinds of sea animals, it has enemies superior in strength to itself, such as the grampus and the cachalot. When its quick eyes perceive one of these huge monsters approaching, it ejects a quantity of its inky fluid into the water, which immediately spreads around into a dark cloud; while the enemy is floundering about, bewildered and astonished, in this murky fog, the nimble cuttle darts away and conceals himself in the mud at the bottom, or the safe fissure of some neighboring rock.

The use of this ink-battery as a means alike of defensive and offensive warfare, is evinced by an anecdote of a British officer, who on a certain



THE CRESTED SEAL.

occasion, had gone ashore to collect shells, happening to be attired in a pair of snow-white pantaloons. As he was walking about, he suddenly came upon a cuttle-fish, snugly harbored in the recess of a rock. For a moment the two stared at each other with mutual surprise; after a time the officer advanced a little, when, quick as thought, the poulpe discharged a spray of ink, and taking good aim at the snowy pants, spattered them with indelible stains, which rendered them, ever after, unpresentable.

This species seems to be widely distributed in almost all seas. In the North Atlantic it is usually of small size, but in the Mediterranean it is sometimes so large as to weigh a hundred pounds; the body of one has been seen of the size of a barrel, and with arms as thick as those of a

man. In the tropical seas they are said to be much larger, and so fierce as sometimes to attack boats and drag them under water. We are told that in the Indian waters, such things have actually happened, and in certain localities the boatmen always keep themselves supplied with axes to cut off the arms of these monsters, in case of an attack.

Their remarkable spirit, as well as their strength, is evinced by an adventure which Mr. Beale, an Englishman, had with one of them among the rocks of the Bonin Islands, where he had gone ashore to seek for shells. As he was moving about, he was suddenly arrested by seeing at his feet a most extraordinary looking animal, crawling toward the



A SAVAGE FOE.

surf, which it had only just left. It was creeping on its eight legs, which, from their soft and flexible nature, bent considerably under the weight of its body, so that it was lifted by the efforts of its limbs only a small distance from the rocks. It appeared much alarmed at seeing him, and made every effort to escape. A moment after, the apparently enraged animal lifted its head with its large projecting eyes, and loosing its hold of

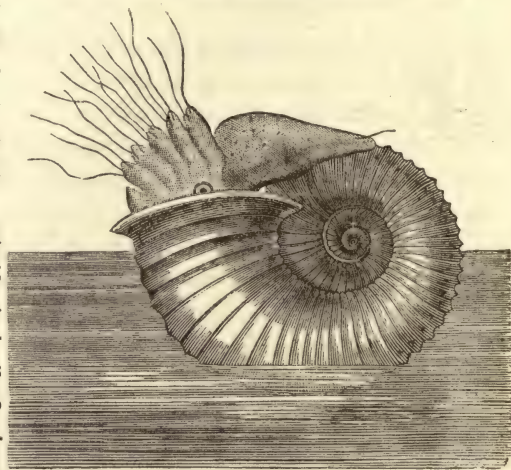
the rocks, suddenly sprang upon Mr. Beale, and clung to him by means of its suckers with great power, endeavoring to get its beak, which could now be seen between the roots of its arms, in a position to bite. A sensation of horror pervaded his whole frame, when he found that this hideous animal had fixed itself to him so firmly. Its cold, slimy grasp was extremely sickening; and he loudly called to the captain, who was at some distance, to come and release him from his dangerous assailant. The captain quickly came, and soon released him, by destroying his tormentor with the boat-knife, which he accomplished by cutting away portions at a time.

The presence of this monster in the tropical seas often adds a fresh

danger to the ordinary perils of pearl-diving. It has been known to attack men under water, and numerous instances are recorded of its fatal assault. Once within its powerful grasp, the situation is extremely critical. It has no mercy on its victim, and when it throws about him its immense arms he is in the jaws of an embrace that means death. The natives are compelled to arm themselves with the most effective weapons against a foe so ferocious and hard to overcome.

The ammonites, a curious genera of mollusks, become quite special in the secondary epoch, and disappear altogether before our age. They are characteristic of a very early period, and each zone is characterized by its peculiar species. The name is taken from the resemblance of the shell to the ram's-horn ornaments which decorated the front of the temple of Jupiter Ammon and the bas-reliefs of the statues of this pagan deity. They were cephalopode mollusks with circular shells, winding in spirals on the same plane, and divided into a series of chambers.

The animal only occupied the outer cavities of the shell; all the others were void. A tube issuing from the first traversed all the cavities. This enabled the animal to rise to the surface, or sink to the bottom, for the ammonite could at pleasure fill the chambers



THE ANCIENT AMMONITE.

or expel the water, thus rendering it lighter or heavier as occasion required. The nautilus of our seas is provided with the same curious organization, and reminds us forcibly of the ammonites of geological times. Shells are the only traces which remain of the ammonites. Like a little sculler, the ammonite floated on the surface of the water; like the nautilus, the shell was an animated skiff. What a curious aspect these primitive seas must have presented, covered by myriads of these mollusks of all sizes, rowing about in eager pursuit of their prey!

CHAPTER III.

THE WORKMEN OF THE SEA.

The Ocean a Nursery of Life—World-Makers—Destruction of the Weaker Marine Tribes—Half Plants and Half Animals—Graceful Forms and Brilliant Hues—Flowers of Ocean—Astounding Multitude of Infusoria—Mountains Formed from Tiny Shells—Islands Built by Coral Insects—Magnificent Paris Built by Animalcules—Coral Forests in the Sea—Coral Islands Hundreds of Miles in Extent—Ships in Danger—The Birth of New Lands—The Marvelous Actinia—Plants of Living Stone—Myriad Forms of Life in the Sea—Depths of Amazing Splendor—The Humming Birds of the Ocean.



HE circulation of the ocean, its phosphorescence, and the tints of color belonging to certain seas, make known but imperfectly what can be accomplished by the incalculable numbers, the prodigious fecundity, and the devouring activity of the minute animals, scarcely perceptible individually, with which it teems. Yet geology demonstrates that it was they which laid the foundation of animal life in that immense cradle, that inexhaustible "nursery" as Maury calls it; it is they which maintain a never-varying identity in the composition of its waters, absorbing and changing the mineral and organic properties with which these are incessantly loaded.

There are some which serve as the food of stronger and superior species; these, in their turn, nourish the fish and crustaceans, which are themselves devoured by far larger fishes. There are others which are indefatigable architects.

A myriad laborers ply their task,
And what it tends to never ask.
The work how grand! the means how small!
What wondrous order reigns o'er all!

They construct the fantastic edifices that from the depths of ocean mount to its very surface, and spread afar, ramify, and terminate in coral reefs and islands. Michelet calls them "world-makers." Others, finally, by dying, have accumulated at certain points their skeleton wrecks, and have formed numerous banks, and shallows, and entire beds of deposit, where the geologist to-day may study these first-born of creation. These infusoria, these polypes, were preceded, in the primeval sea, in the universal ocean, by vegetables properly so called, similar to those which, at the present time, are met with in the torrid zone.

These vegetable species, then, have remained almost stationary; their number is now confined within comparatively narrow limits, and we see nothing in this Neptunian flora which at all approaches the astonishing variety of the terrestrial, although there are flowers of the ocean whose beauty rivals that of the lily and rose. The genera or tribes which really compose the flora of the sea are those zoophytes (half plants, half animals), those lithophytes (half plants, half stones), which cover its mountains and valleys with forests of coral and madrepore with gigantic and inextricably inter-woven branches: such are the anemones, the actinias, the marvelous shells which, thanks to their graceful forms and brilliant hues, are ornaments no less rich and curious for the submarine meadow and plain, than for our terrestrial fields the flowers are that expand in the sunshine and are fed by the morning dew.

Plants and Animals Combined.

These mixed beings, with a vegetative life, yet provided with organs proper to the animal kingdom, and endowed with instincts and faculties, rudimentary, it is true, but clearly manifest, are one of the most characteristic features of the Neptunian creation. It is not even certain whether this creation has really produced any plants, properly so called, and whether the weeds, so long and so unhesitatingly classed in the vegetable kingdom, are not also produced like the corals and lithophytes, by the polypes, or living creatures, inhabiting them, which there develop and reproduce themselves indefinitely.

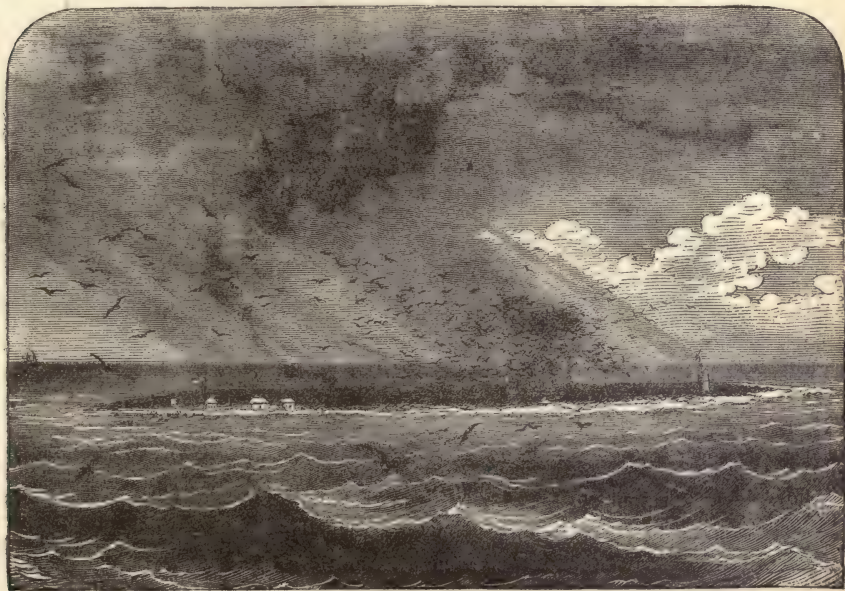
Let us now consider the infusoria, the world makers, whose débris are discovered in prodigious quantities among the remains of the primitive creation. The name "infusoriæ" has been given to them because they were first observed in liquids holding in dissolution or in infusion particles of matter. The accumulated spoils of these infinitely small organisms constitute a notable part of the solid crust of our globe; and we ourselves are eye-witnesses of the phenomena of continual reproduction and destruction by which they made ready, at the epoch of the ancient geological formations, the habitation of man.

Astonishing Multitude of Animalcules.

According to Ehrenberg, a cubic inch of the Tripoli sand which is still in the course of formation in the environs of Bilin, in Bohemia, contains thousands of shells of the infusoria which produce this friable substance. The same naturalist states that, so great is their power of reproduction, one million of these animalcules are born in a few days. Bearing these facts in mind, it is not difficult to understand what immense masses of matter must have been deposited by the innumerable genera-

tions which have succeeded one another during the long periods of the primitive epochs, and which have covered with accumulated sediment the rocks of fiery origin that formed the first crust of the earth. The fossil débris of larger shells are also found in vast masses, which sufficiently indicate the infinite multiplication of life in the dense warm waters of the primeval seas.

The illustrious geologist, Buckland, affirms that the shells of infusoria form a considerable portion of the entire mass of several mountains; as, for instance, the formations of the Alps, the Carpathians, and the Pyrenees. The famous colossal Sphinx, and the hugest of the Egyptian pyre-



AN ISLAND IN MID-OCEAN FORMED BY CORAL INSECTS.

amids—that which is generally distinguished by the name of Cheops—are constructed of a limestone wholly composed of these minute creatures which are everywhere widely distributed, and which, by their countless legions, seem to have sought a compensation for their extreme dimutiveness. The sand of the sea-shore is so filled with them that one may justly say it is half composed of them. In an ounce of sand, in the West Indies, it was estimated that there were nearly four thousand of individuals.

The banks formed by the remains of these beings impede navigation and render it dangerous, obstruct the gulfs, fill up the harbors, and, in

conjunction with the madrepores, construct those islands which from time to time emerge in the warm regions of the great ocean; and this rôle, actually played out to-day by living species, was formerly filled by those which are now found only in a fossil condition.

At the epoch of the coal formation a single species built up in Russia enormous beds of lime-stone. The deposits reveal an immense quantity in the white chalk in England. Finally, in numerous localities, and especially in the environs of Paris, the limestone-grit encloses an infinite number.



A CORAL SHRUB.

Paris, as well as many neighboring towns and villages, is almost wholly built with these infusoria. Thus, then, animals, hardly perceptible to the unassisted eye, change to-day the depths of the waters, and have, at various geological epochs, filled up basins of a considerable area. This fact shows us that each animal has its allotted task, and that with time—time, of which nature takes no count—the animals which appear to us so contemptible on account of their smallness, might change the aspect of the globe.

This is not the only, nor is it the most curious example, that we might put forward of the immense share given to the zoophytes in the construction of the earth's crust and the ocean's bed. One species has only played a passive part in this phenomenon, consisting simply in the accumulation of shells over places long covered by the waters. This is not the case with another species, the polypes, whose astounding labors are almost incredible. Not only are these remarkable for their rapid increase but they are admirable workmen, skillful engineers, building up in the liquid depths, with the materials there held in suspension, massive monuments which



A SPONGE WITH CORALLINE ATTACHED.

dwarf into the work of pigmies the most gigantic constructions of ancient and modern peoples.

In the torrid zone, says Cuvier, where the lithophytes are numerous in species and propagate abundantly, their stony trunks intertwine themselves into rocks and reefs, which, rising to the surface of the water, close up the mouth of harbors, and lay the most terrible snares for navigators. The sea throwing up sand and mud on the summit of these reefs, sometimes raises their surface above its own level, and forms them into level islands, which in due time rich vegetation vivifies. These polypids belong exclu-

sively to tropical regions, and rarely overpass the 27th parallels of north and south latitude, unless in localities marked by special conditions, as where the Atlantic is warmed by the Gulf Stream.

They are also found among the Bermuda Islands—Shakespeare's "still-vest Bermoothes." The tropical regions of the Pacific Ocean abound in prodigious quantities of coral, which have been converted into Summer-isles of Eden, lying in dark purple spheres of sea.

We know that these lithophytes have given the name of the "Coral Sea" to the "glowing tracts" comprised between the north-east coast of New Holland, the south-east coast of New Guinea, the Solomon Islands, the New Hebrides, and New Caledonia. They abound, moreover, in the Persian and Arabian Gulfs, as well as in the part of the Indian Ocean comprised between the Malabar coast and the Island of Madagascar. Flinders computes a reef of polypids situated on the east coast of Australia, and known as the Great Barrier Reef, at a length of 1086 miles, and he describes it as without gap or break over an extent of 380 miles. Groups of coral islands exist in the Pacific, which spread over an area of 1080 to 1300 miles in length, and 330 to 435 miles in breadth: such are the dangerous Archipelago, and those which the Russian navigator, Kotzebue, named Radack.

Vast Beds of Living Stone.

These lithophytic, or coral banks, are generally developed with extreme slowness. Ehrenberg ascribes to certain isolated polypids in the Arabian Gulf, which measure only two to four yards in diameter, an antiquity of several thousands of years. The coral reefs affect various forms; nevertheless, the most general consist, at least in the Pacific, of a ring or belt of dry ground, circular or oval, enclosing a lagoon of shallow and tranquil water, abounding with zoophytes and mollusks. These islands scarcely rise above the level of the water, and the sea surrounding them is often of unfathomable depth. Out of thirty-two examined by Beechey, twenty-nine had lakes or lagoons in the centre, the bases formed of coral; and as these are gradually filling up by the labors of the insects, and the deposition of sand and lithophytic matters, they will in due time vanish, and a uniform mass of land present itself. At Durie's Island, the central lagoon was partly enclosed by trees, and the water being exquisitely transparent, the reflected picture was one of extreme beauty. The corallines were of various colors—rose, pink, azure, yellow, lilac, snow-white; and numerous small fish of brilliant hues, darting rapidly to and fro among the coral labyrinth, produced an effect of extremely fantastic character.

The examination of a coral reef, says Captain Basil Hall, during the different stages of one tide, is particularly interesting. When the sea has left it for some time, it becomes dry, and appears to be a compact rock, exceedingly hard and ragged; but no sooner does the tide rise again, and the waves begin to wash over it, than millions of coral worms protrude themselves from holes on the surface which were before quite invisible.

These animals are of a great variety of shapes and sizes, and in such prodigious numbers, that in a short time the whole surface of the rock appears to be alive and in motion. The most common of the worms at

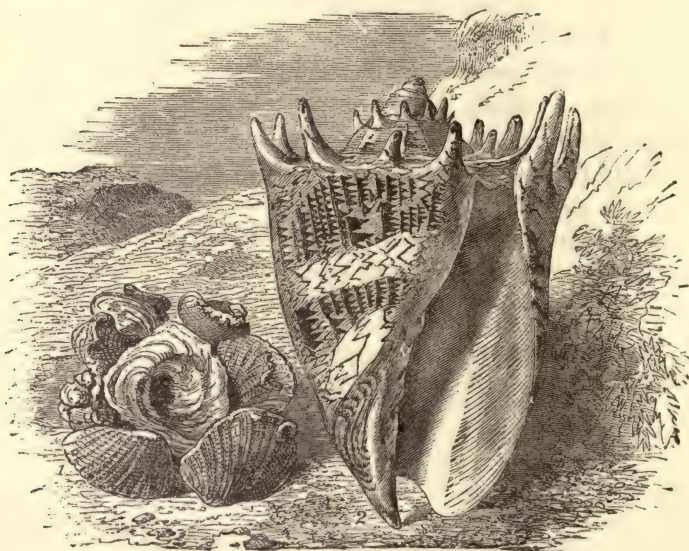


SCALY-CLAWED CRUSTACEAN.

Loo Choo was in the form of a star, with arms from four to six inches long, which it moved about with a rapid motion in all directions, probably in search of food. Others were so sluggish that they were often mistaken for pieces of the rock; these were generally of a dark color, and from four to five inches long, and two or three round. When the rock was broken from a spot near the level of high water, it was found to be a hard solid stone; but if any part of it were detached at a level to which the tide reached every day, it was discovered to be full of worms of all different lengths and colors, some being as fine as a thread, and several feet long,

generally of a very bright yellow, and sometimes of a blue color ; while others resembled snails, and some were not unlike lobsters and prawns in shape, but soft, and not above two inches long.

The growth of coral ceases when the worm which creates it is no longer exposed to the washing of the tide. Thus a reef rises in the form of a gigantic cauliflower, till its top has gained the level of the highest tides, above which the worm has no power to carry its operations, and the reef, consequently, no longer extends itself upwards. The surrounding parts, however, advance in succession till they reach the surface, where they also must stop. Thus, as the level of the highest tide is the eventual limit to every part of the reef, a horizontal field comes to be formed coincident with that plane, and perpendicular on all sides.



SPECIMENS OF BIVALVE AND UNIVALVE SHELLS.

The reef, however, continually increases, and being prevented from going higher, must extend itself laterally in all directions ; and this growth being probably as rapid at the upper edge as it is lower down, the steepness of the face of the reef is preserved ; and it is this circumstance which renders this species of rock so dangerous in navigation. In the first place, they are seldom seen above the water ; and in the next, their sides are so abrupt that a ship's bows may strike against the rock before any change of soundings indicates the approach of danger.

When the reef is of such a height as to be almost wholly uncovered at

low water, the zoophytes discontinue their toils. Below the line which they have traced, you then discover a continuous stony mass, composed of shells and mollusks, with their bristling spikes, and fragments of coral connected by a calcareous sand, proceeding from the pulverization of the shells. It often happens that the heat of the sun penetrates this mass when it is dry, and causes it to split open in many places; the waves then possess sufficient force to divide it into blocks of coral about six feet long by three or four and a half feet broad, and to hurl them upon the reef; this operation terminates in the elevation of such a crest that the high tides only wash over it at certain periods of the year.

The sand does not experience any further change, and offers to the seeds brought thither by the waves a soil wherein vegetation flourishes with sufficient rapidity to speedily overshadow its dazzling white surface. Whole trunks of trees, transported by the rivers from other countries and other islands, find there at length, after a protracted voyage, a resting-place. Some small animals, such as insects or lizards, are conveyed among them, and usually become the first inhabitants of these reefs. Even before the trees are thick and leafy enough to form a wood, the sea-birds build their nests among them; stray terrestrial birds seek refuge in the copses; and finally, long after the polypes have accomplished their work, man appears, and erects his hut on the fertile soil.

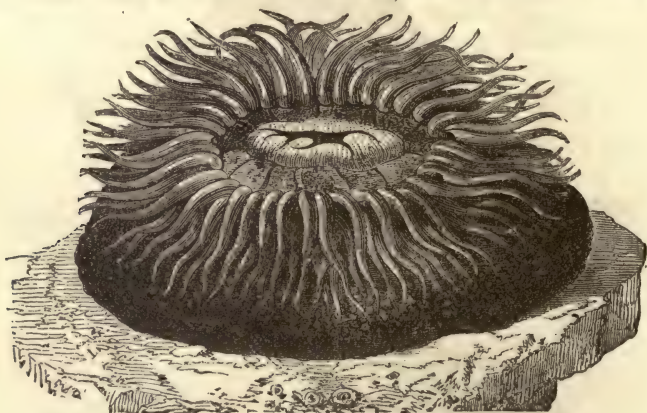
Millions of millions thus, from age to age,
With simplest skill and toil unwearable,
No moment and no movement unimproved,
Laid line on line, on terrace terrace spread,
To swell the heightening, brightening, gradual mound,
By marvellous structure climbing towards the day.
Each wrought alone, yet all together wrought,
Unconscious, not unworthy, instruments,
By which a Hand invisible was rearing
A new creation in the secret deep.
Omnipotence wrought in them, with them, by them;
Hence, what omnipotence alone could do,
Worms did. I saw the living pile ascend,
The mausoleum of its architects,
Still dying upwards as their labors closed;
Slime the material, but the slime was turned
To adamant by their petrific touch;
Frail were their frames, ephemeral their lives,
Their masonry imperishable. All
Life's needful functions, food, exertion, rest,
By nice economy of Providence,
Were overruled to carry on the process
Which out of water brought forth solid rock.

Atom by atom thus the burthen grew,
Even like an infant in its growth, till Time
Delivered ocean of that monstrous birth—
A coral island stretching east and west.

But there are coral formations even exceeding in wonder anything we have yet observed. There are plants and living stones rivalling the beauty of any flower garden blooming upon the land. The little insects appear to have an eye for symmetry and exquisite colors.

The flowering actinia has long flexible branches ramified towards the extremity, which resemble the branches of a tree.

There is also an actinia called the plumosa which is generally white, but is sometimes yellow or orange, the mouth of which is surrounded by lobes, furnished with numerous tentacles, or branches. Both of these



WHITE ACTINIA OF ST. HELENA.

forms are presented in the engravings which are annexed. These are simply animated stones.

Thus under a surface much less varied than that of the mainland, remarks Humboldt, the sea contains in its bosom an exuberance of life of which no other region of the globe affords any idea. Charles Darwin justly observes that our terrestrial forests do not afford an asylum to nearly so many animals as do those of ocean. For the sea has likewise its forests, consisting of the long marine herbs which flourish in shoal and shallow, or the floating banks of fucus which the waves and currents have detached, and whose loose and slender branches are raised to the surface by their air-swollen cells, consisting, moreover, of those stony plants, embracing immense areas both in height and breadth, whose encroachments would become formidable were it not for the extreme slowness with which the polypes accomplish their indestructible work.

There are glorious forests, as well as the superb gardens where ocean displays all the gorgeous treasures of its living flora, and there are animated plants which have long perplexed and embarrassed our scientific men; embarrassed them not unreasonably, nor are they yet free from trouble, only the trouble has changed its direction—for to-day our naturalists, having recognized as animals the strange half-formed beings which they formerly took for plants, have begun to ask if those other



CATCHING A HUGE TURTLE.

so-called plants may not also be animals, or at least polypes; whether, in a word, the whole vegetable kingdom is not a fiction!

What hidest thou in thy treasure-caves and cells,
Thou hollow-sounding and mysterious main?

The sea conceals arcana in its depths which no glance can penetrate, which no genius can depict except with the help of imagination. In the aerial and terrestrial worlds, and even in the celestial space, nature liberally unrolls before our eyes her marvelous pictures. From one

pole to the other we may explore all the parts of our domain ; we may ransack the very bowels of earth ; or, raising our gaze towards the firmament, contemplate the immense panorama of the worlds, measure the dimensions and the distances of the stars, follow them in their courses, calculate their orbits and even their densities ; but of this ocean, this thin stratum of water a few thousand yards in thickness, stretched over our planet, we know by sight only the surface and the borders. There only can man grapple with Neptunian nature ; and so much as he is permitted to embrace—the strange, grand, and diversified character of the scenes which ocean presents in certain regions and under favorable



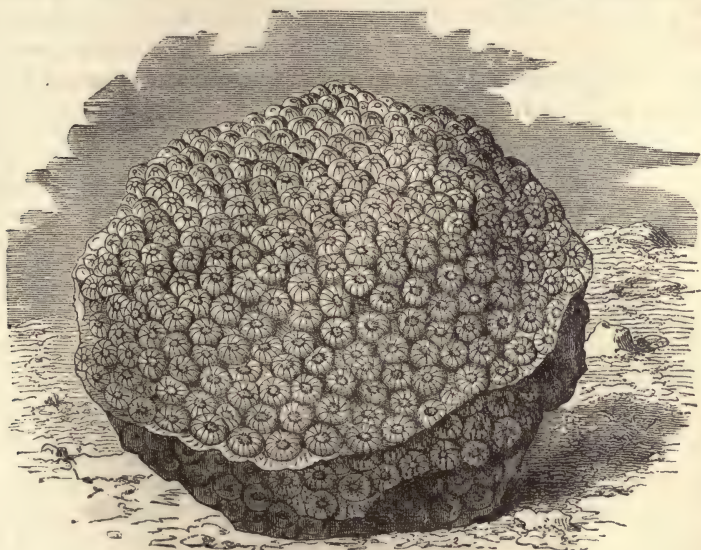
A SEA-FLOWER IN LIVING STONE.

conditions—increases our regret that we are reduced to such limited and fugitive glimpses, by leading us to presume, from the little we can see, the splendor of that which remains unseen.

A seaman placed in the midst of the ocean, says Maury, experiences, on contemplating its surface, sentiments similar to those of the astronomer when he observes the stars, and interrogates the night upon the profundities of the skies. We may judge what his feelings are, in fact, from the following description, which a learned German traveller, Schleiden, has given of the spectacle presented to the navigator in the boundless plains of the tropical sea : If we plunge our glances into the liquid crystal of the Indian Ocean, we shall see realized therein the marvelous appearances of

the fairy tales of our infancy. Fantastic shrubs are decked with living flowers. Everywhere glow the most brilliant colors ; glaucous greens alternate with brown and yellow ; rich purple tints subside into the liveliest red or intensest blue.

Rosy, yellow, or peach-colored crusts cover the decayed plants, and are themselves enveloped in black tissue which resembles the most delicate, carved ivory. By their side waver to and fro the yellow and blue fans of



A STONE WITH STAR CLUSTERS.

the gorgons, richly wrought like jewels of filigree. The sand is besprinkled with sea-hedgehogs and sea-stars, of fantastic forms and varied colors. Resembling gigantic cactus flowers, glittering with glowing hues, the sea-anemones adorn the rocks with their crowns, or spread over the ocean-bed like a growth of brilliant vines. The humming-birds of ocean—small gleaming fishes, some bright with a metallic splendor of azure or vermillion, some with a gilded green or dazzling silver lustre—play around the coral bushes.

Each moss,
Each shell, each crawling insect, holds a rank
Important in the plan of Him who framed
This scale of beings ; holds a rank which, lost,
Would break the chain, and leave behind a gap
Which nature's self would rue.



CHAPTER IV.

RARE SPECIMENS OF OCEAN LIFE.

The Famous Narwhal—Many Teeth in One—Strange Superstitions as to the Sea—Unicorn—A Formidable Weapon—The Best Kind of Ivory—Narwhal Fishing—An Arctic Black Hole of Calcutta—Immense Size of the Narwhal—The Huge Grampus—"The Killer" Capturing Seals—Story of the Whale—Flashes like Lightning from the Waves—The Hairy Medusæ—A Wake of Silvery Light—"All Hands Ahoy!"—Whale Fishing and its Dangers—Sea-Birds and Their Curious Habits—The Elegant Black-Backed Gull—Laughing Gull—"Haw, ha, ha, Haw!"—Birds that are Pirates—The Sea-Mew and its Island Home—The Wonderful Island of Saint Kilda—Humming-Birds of the Ocean—Colors that Dazzle the Eye—Beautiful Specimens of Scaly-Finned Fishes—Flag-Fish—Coral-Fish—Rock-Fish—Whip-Fish—Duke-Fish—Emperor-Fish—The Sharp-Shooter of the Sea—Good Aim and Successful Shot—A Fish With Two Lungs—Burrowing in the Mud—Savage Fighters—A Fish that Hisses—The Frog-Catcher—Curious Climbing Fish—Experiments with the Mud-Jumper—A Slug-gard that Proves to be Swifter than an Arrow.

NARWHALS differ very little from porpoises in their general form and the color of their bodies; but at the first glance they are easily to be distinguished from all other cetaceans by the singular tusk with which nature has provided them. Of the two incisive teeth implanted in the upper jaw of the narwhal, one is almost entirely wanting, whilst the other is prodigiously lengthened in a straight line, and is simply an enormous stiletto, which is rounded with a spiral fluting, a sharp point at the extremity, and which is of one-third or half the length of the animal. This strange creature has then but one tooth—and what a tooth! It is, in fact, a sword of ivory. In the Museum of Natural History at Amsterdam and other collections, there is a narwhal skull with two fully developed tusks.

There have been, both among the ancients and the moderns, many stories about the narwhal's tooth. It was formerly considered to be like the horn of the unicorn, which was situated on the middle of the forehead. This fabulous being resembled, they said, the horse and the stag. Aristotle and Pliny have described it, and it is represented on many ancient monuments. It was adopted by the chivalry of the middle ages, and has often decorated the trophies in military fêtes.

In former times people attributed to the tooth of the narwhal, which they called the tooth of the unicorn, marvelous medicinal virtues. They

considered it an infallible antidote to all poisonous compounds; they were persuaded that it counteracted all the hurtful properties of venomous substances. Charles IX., dreading lest he should be poisoned, was very careful to put into his cup of wine a piece of the sea-unicorn's tooth. Ambroise Paré was the first who dared to lift up his voice against such errors. Very soon after the unicorn ceased to be an object of exorbitant price on account of its supposed virtues. It then passed from the apothecary's laboratory to the naturalist's collection, where it was long preserved under the name of horn or tusk of the unicorn.

The true nature of this horn was shown for the first time by a naturalist who had found it affixed in its socket in a skull similar to that of a whale. But it was not till 1671 that Frederick Martens gave a tolerably correct description of the narwhal. These narwhals live in the neighborhood of Iceland and in the seas which wash the shores of Greenland. They gather together in the creeks of the ice islands, and travel in bands. It would be very difficult to take them if they did not live in troops; for, when isolated, they swim with such rapidity as to escape from all pursuit. But when they are near together they mutually embrace each other, and are easily caught. When the fishing-boats glide cautiously in between their long files they close their ranks, and press against each other so much that they paralyze each other's movements; they become entangled in the tusks of those near them, or else, lifting their heads in the air, they rest their tusks on the backs of those which are in front of them. They can from that minute neither retreat, nor advance, nor fight, and they fall under the blows of the sailors, who are in the boats.

How the Narwhal Obtained its Name.

The Icelanders manufacture with the narwhal's tusks their arrows for the chase, and the poles which they use in the construction of their huts; but they do not eat its flesh, because they believe it to be venomous. The name this animal bears was given to it by the Icelanders. The meaning of the word is, "Whale that feeds on dead bodies;" for the word *nar* in their language means dead body or carcass, and the word *whal*, whale. This is not the case, however, with the Greenlanders, and other inhabitants of the North, who esteem it excellent. They dry it by exposing it to smoke. The oil furnished by the narwhal is, it is said, preferable to that of the whale.

Naturalists are not agreed as to the use of the narwhal's formidable weapon. They say that they use it in their attacks on the whale, and that they kill this monster by running their sword into its belly. Lacépède says that their tusks have been found deeply implanted in the bodies of

whales; but other authors formally deny that battles ever take place between these two terrible combatants. Narwhals sometimes rush with prodigious speed and force against vessels, which they no doubt take for some gigantic prey. If the animal attack the ship on the side as it is sailing, the tooth, imbedded in the wood, breaks off; but if it attack it from behind, the narwhal remains fixed to the ship; it is then dragged along and towed till it dies.

A Savage Weapon.

Certain naturalists, relying on the fact that the narwhal's tusk is smooth towards the end, which is sometimes rounded, and, as it were, worn away, have concluded that the animal uses its horn for piercing ice, when it wants to come up and breathe and to save itself a long journey to the open water. Others have thought that these traces of wear and tear of its weapon arise from the friction of it in sand or against rocks, when the animal is looking there for its food, which consists of cuttle-fish, flat-fish, cod, ray, oysters, and other mollusks. And, lastly, it has been stated that the narwhal uses its natural lance for attacking its prey, for killing it, and perhaps also for tearing it up before it devours it. Thus the narwhal's tooth would seem to be at the same time an instrument which serves to satisfy the wants of the ordinary life of the animal, useful to it for its respiration, its nutrition, and, at the same time, an offensive and defensive weapon.

Narwhals are not always brutal and warlike. Scoresby saw some very merry bands of these marine animals; they raised their horns and crossed them, as if they were going to fence, and they followed the ship with a sort of wild curiosity. The ivory of the narwhal's tusk is an object of value; it is more compact, harder, and susceptible of a finer polish than that of the elephant. It is on this account that visitors to the library of Versailles are shown a walking-stick made of narwhal ivory inlaid with mother-of-pearl. Of this ivory is made an ancient throne of the kings of Denmark, which is to be seen in the Castle of Rosenberg.

A most excellent observer remarks that the narwhal is gregarious, generally travelling in great herds. I have seen, he relates, a herd of many thousands travelling north in their summer migrations, tusk to tusk and tail to tail, like a regiment of cavalry, so regularly did they rise and sink into the water in their undulatory movements in swimming. It is very active, and will often dive with the rapidity of the right whale, taking out thirty or forty fathoms of line. These schools are not all of one sex, but consist of males and females mixed. The use of the tusk has long been a matter of dispute: it has been supposed to use it to stir up

its food from the bottom ; but if such were the case, the females would be sadly at a loss. They seem to fight with them ; for it is rarely that an unbroken one is obtained, and occasionally one may be found with the point of another jammed into the broken place, where the tusk is young enough to be hollow, or entirely lost close to the skull.

A Popular Breathing Place.

Fabricus thought that these horns were to keep the holes open in the ice during the winter ; and the following occurrence seems to support his view : In April, 1860, a Greenlander was travelling along the ice in the vicinity of Christianshaab, and discovered one of those open places in the ice which, even in the most severe winters, remain unfrozen. In this hole hundreds of narwhals were protruding their heads to breathe, no other open spot presenting itself for miles around. It was described as akin to an Arctic Black Hole in Calcutta, from the crowding of the narwhals in their eagerness to keep to the place. Hundreds of Eskimo and Danes resorted thither with their dogs and sledges and while one shot the animal another harpooned it, to prevent its being pushed aside by the anxious crowd of fishermen. Dozens of narwhals were killed, but many were lost before they were brought home, the ice breaking up soon after. In the ensuing summer the natives found many dead washed up in the bays and inlets around. Neither the narwhal nor the whale are timid animals, but will approach close to, and gambol for hours in the immediate vicinity of a ship.

In the female of the narwhal the tusks are rudimentary, but are about ten inches long, rough, and with no inclination to spire ; in fact, not unlike a miniature piece of pig-iron. On the other hand, the undeveloped tusk in the male is smooth and tapering, and wrinkled longitudinally. Double-tusked narwhals are not uncommon. They have been seen swimming about among the herd, and several such skulls have been preserved. The color of the animal is grayish, or velvet-black, with white spots, sometimes roundish, but more frequently irregular blotches of no certain outline, running into one another. There are no spots on the tail or flippers, but waxy-like streaks shade off on each side at the junction of the tail, which is white at the line of indentation. The female is more spotted than the male. The young is, again, much darker ; and individuals have been seen which were almost white, like the one Anderson describes as having come ashore at the mouth of the Elbe. In a female, killed at Pond's Bay, the stomach was corrugated in complicated folds, as were also the small intestines. It contained crustaceans, bones of fishes, and an immense quantity of the horny jaws of some species of



ICELANDERS CAPTURING NARWHALS,

cuttle firmly packed one within the other. The narwhal is chiefly an inhabitant of the Polar regions, and very rarely strays to temperate latitudes; still fossil remains of it have been found both in England and France. A male taken entangled among the rocks at the entrance of the sound of Weesdale, in Zetland, measured twelve feet, exclusive of the tusk. Such is the velocity of this animal and the impetus of its course, that it has been known to plunge its tusk through the side of a vessel, which has been snapped off in the timbers by the violence of the blow.

We must allude, in passing, to one or two other animals belonging to this group.

Among the most remarkable is the grampus, a huge creature from twenty to thirty feet in length, with his jaws armed with a row of formidable teeth. His voracity is such, that he is called "the killer," and wonderful stories are told



HAIRY MEDUSÆ.

of him by the Greenland whalers. One of them says, "Where these appear all the seals disappear, else they make desperate slaughter among them, for they have such sagacity and skill in catching them with the mouth and fins, that they are sometimes seen loaded with five at a time—one in the mouth, a couple under each fin, and one under the back fin!"

Another enormous creature belonging to this group is the whale, of which a further description is not needed here, but which furnishes an interesting incident, related by a traveller, and one worth reproducing. The ship's crew had been compelled to abandon their vessel, and what followed is told in the graphic language of the narrator: The night following our abandonment of the ship was made memorable by a remarkable specta-

cle. Slumbering in the bottom of the boat, Jarl and I were suddenly awakened by Samoa. (Jarl and Samoa were two of the ship's crew.) Starting, we beheld the ocean of a pallid white color, coruscating all over with tiny golden sparkles. But the pervading hue of the water cast a cadaverous gloom upon the boat, so that we looked to each other like ghosts. For many rods astern, our wake was revealed in a line of rushing illuminated foam; while, here and there beneath the surface, the tracks of sharks were denoted by vivid, greenish trails, crossing and recrossing each other in every direction. Further away, and distributed in clusters, floated on the sea, like constellations in the heavens, innumerable medusæ, a species of small, round, refugent fish, only to be met with in the South Seas and the Indian Ocean.

Suddenly, as we gazed, there shot high into the air a bushy jet of flashes, accompanied by the unmistakeable deep-breathing sound of a sperm whale. Soon the sea all round us spouted in fountains of fire; and vast forms, emitting a glare from their flanks, and ever and anon raising their heads above water, and shaking off the sparkles, showed where an immense shoal of cachalots had risen from below, to sport in these phosphorescent billows.

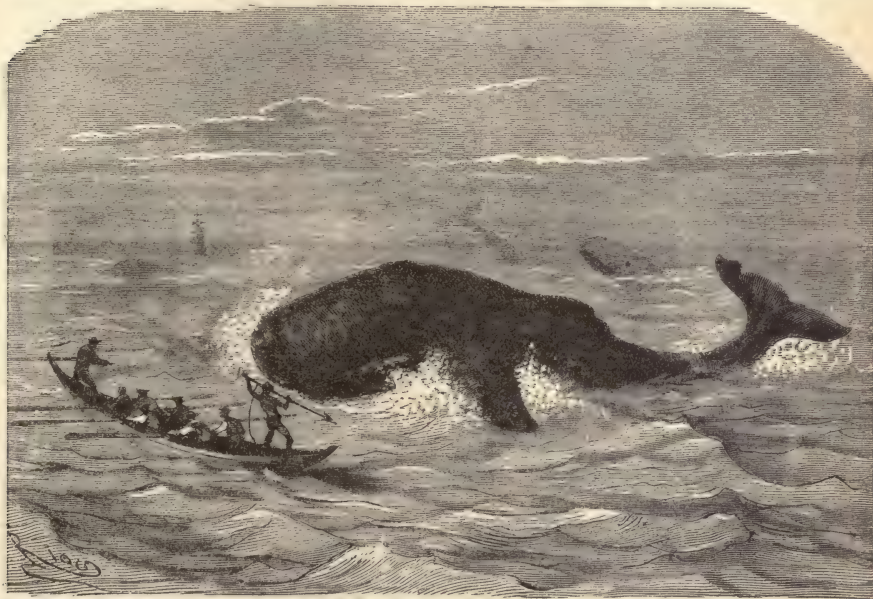
A Sudden Plunge and Silvery Wake.

The vapor jetted forth was far more radiant than any portion of the sea; ascribable, perhaps, to the originally luminous fluid, contracting still more brilliancy from its passage through the spouting canal of the whales. We were in great fear lest, without any vicious intention, the leviathans might destroy us by coming into close contact with our boat. We would have shunned them, but they were all round and round us. Nevertheless we were safe; for, as we parted the pallid brine, the peculiar irradiation which shot from about our keel seemed to deter them. Apparently discovering us of a sudden, many of them plunged headlong down into the water, tossing their fiery tails high into the air, and leaving the sea still more sparkling from the violent surging of their descent. Their general course seemed the same as our own; to the westward. To remove from them, we put out oars, and pulled towards the north. So doing, we were steadily pursued by a solitary whale that must have taken our boat for a kindred fish. Spite of all our efforts, he drew near and nearer; at length rubbing his fiery flank against the gunwhale, here and there leaving long strips of the glossy transparent substance, which, thin as a gossamer, invests the body of the cachalot.

In terror at a sight so new, Samoa shrank. But Jarl and I, more used to the intimate companionship of the whales, pushed the boat away

from it with our oars, a thing often done in the fishery. But, to my great joy, the monster at last departed, rejoining the shoal, whose lofty spoutings of flame were still visible upon the distant line of the horizon, showing there like the fitful starts of the aurora borealis.

The sea retained its luminosity for about three hours, at the expiration of half that period beginning to fade; and, excepting occasional faint illuminations, consequent upon the rapid darting of fish under water, the phenomenon at last wholly disappeared. Heretofore, I had beheld several exhibitions of marine phosphorescence, both in the Atlantic and Pacific; but nothing in comparison with what was seen that night. In the



PERILOUS ENCOUNTER WITH A WHALE.

Atlantic there is very seldom any portion of the ocean luminous, except the crests of the waves, and these mostly appear so during wet murky weather. Whereas, in the Pacific, all instances of the sort previously coming under my notice had been marked by patches of greenish light, unattended with any pallidness of the sea. Save twice on the coast of Peru, when I was summoned from my hammock by the alarming cry of "All hands ahoy! tack ship!" and rushing on deck, beheld the sea white as a shroud; for which reason it was feared we were on soundings.

It appears, on the whole, that the Norwegians were the first to capture

the whale, and that as early as the ninth century. We next find the Biscayans so actively engaged in the business as to furnish harpooners to the English, Dutch, and Flemings, who, in the sixteenth century, commenced the whale fishery near Newfoundland. The Dutch were at first far more successful than the English; but towards the close of the last century, the latter girded themselves to the task, and soon outstripped all their competitors. Whale-fishing is undertaken in boats, which approach as near as possible to the animal. The harpooner strikes his weapon into the back, either by hand, or by firing it from a gun. The former method, if adroitly practised, is effective at the distance of eight or ten yards, the latter at the distance of thirty yards.

Frantic Efforts to Escape.

The wounded whale makes a convulsive effort to escape, and this is the moment of danger to the pursuers, for it inflicts the most violent blows on the boat from its head, tail, or fin, as it dives—its favorite method of attempting to escape. Its average stay under water is about thirty minutes. On its re-appearance, the boat that harpooned it, together with the others that have come to assist their comrades, start in pursuit, and each harpooner, as he comes up to the whale, plunges his weapon into its back. The time occupied in the capture of course varies with the powers of endurance of the whale. Scoresby says he has known a whale killed in twenty-eight minutes, while in the chase of others sixteen hours have been fruitlessly employed. After the capture the carcass is towed alongside the whaler's ship, and "flensed"—that is, its blubber and whalebone stripped off; the bones and refuse are thrown into the sea.

But what may properly be called the inhabitants of the sea are not all monsters of the deep, nor fishes less in size, and less formidable in appearance. There are sea-fowls, birds of air and water, which excite our wonder by their beauty, daring exploits, great strength of wing, and curious instincts. Whoever has seen these attractive sea-birds near the shore, or far out upon the deep, must have been struck with their appearance, and their manner of life upon the great world of waters.

There are several species of gull, a very numerous race, dispersed along the shores of the ocean in nearly all parts of the world. These are exceedingly voracious birds, continually skimming over the surface of the waves in search of their finny prey, and often following the shoals of fish to great distances. They generally congregate in vast numbers at their breeding-places, which are most frequently rocky islands or headlands in the ocean. Most of them are somewhat migratory, usually visiting northern regions during the summer for the purpose of

incubation. The following lines give an accurate picture of these remarkable birds :

On nimble wing the gull
Sweeps booming by, intent to cull,
Voracious, from the billow's breast,
Mark'd far away, his destined feast.
Behold him now, deep plunging, dip
His sunny pinion's sable tip
In the green wave ; now lightly skim
With wheeling flight the water's brim ;
Wave in blue sky his silver sail
Aloft, and frolic with the gale,
Or sink again his breast to lave,
And float upon the foaming wave.

The great black-backed gull is about thirty inches long ; back lead-gray, head, neck, and lower parts white ; breeds in marshes ; male and female assist in making the nest, which is of grass ; the eggs are three. This bird flies with great ease, and swims buoyantly on the water. It feeds chiefly on fish, and also sometimes on small birds. It has been known to destroy weak lambs ; it is common in the European and American seas. The laughing or black-headed gull is seventeen inches long, and, according to Wilson, is one of "the most beautiful and sociable of its genus." They make their appearance on the coast of New Jersey late in April, and do not fail to give notice of the arrival by their familiarity and loquacity. The inhabitants treat them with the same indifference that they manifest toward all those harmless birds which do not minister either to their appetite or their avarice, and hence the black-heads may be seen in companies around the farm-house, coursing along the river shores, gleaning up the refuse of the fishermen, and the animal substances left by the tide ; or scattered over the marshes and newly-plowed fields, regaling on the worms, insects, and their larvæ, which, the bounty of nature provides for the sustenance of myriads of the feathered race.

A Babel of Birds.

On the Jersey side of Delaware Bay, in the neighborhood of Fishing Creek, about the middle of May, the black-headed gulls assemble in great multitudes, to feed upon the remains of the king-crabs which the hogs have left, or upon the spawn which those curious animals deposit in the sand, and which is scattered along the shore by the waves. At such times, if any one approach to disturb them, the gulls will rise up in clouds, every individual squalling so loud that the roar may be heard at the distance of two or three miles. It is an interesting spectacle to behold this species when about recommencing their migrations. If the weather be

calm, they will rise up in the air, spirally, chattering all the while to each other in the most sprightly manner, their notes at such times resembling the cackling of a hen, but far louder, changing often into a *haw, ha, ha, ha, haw!* the last syllable lengthened out like the excessive laugh of a negro. When mounting and mingling together, like motes in the sunbeams, their black heads and wing-tips, and snow-white plumage, give

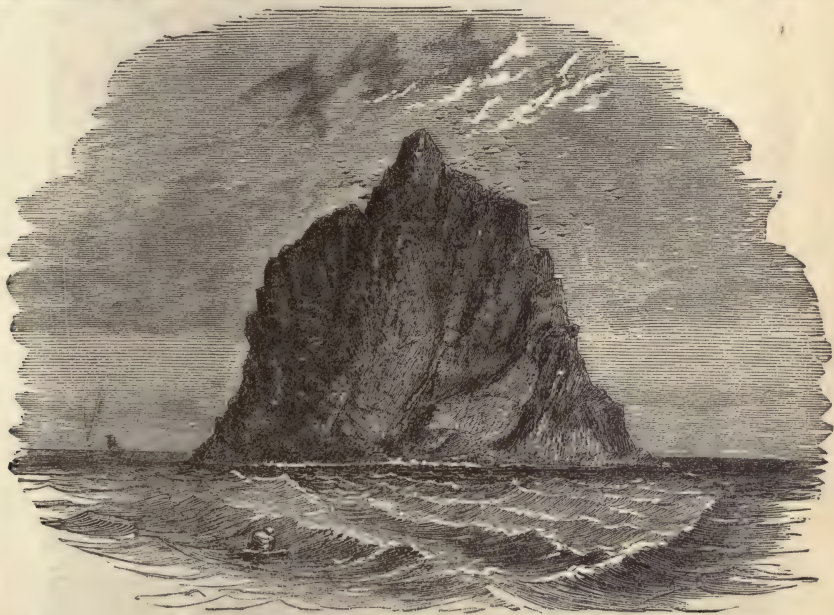


A FLOCK OF SEA-GULLS.

them a very beautiful appearance. After gaining an immense height, they all move off, with one consent, in a direct line toward the point of their destination. This bird breeds in the marshes. The eggs are three in number, of a dun, clay color, thinly marked with small, irregular touches of a pale purple, and pale brown ; some are of a deeper dun, with

larger marks, and less tapering than others ; the egg measures two inches and a quarter by one inch and a half.

The larger gulls are rarely seen except on the high seas. They lead the life of pirates. They cannot dive or plunge on account of the size of their feathers. So they plunder their neighbors, and snatch the fish out of their mouths. The smaller gulls are often near the shore. They wheel about, or skim on the waters, their silvery wings shining in the sun. Sometimes they seem to tread or walk on the waves, upheld by their strong pinions. They will even ascend the rivers in search of prey. They are noisy, greedy, and rapacious. They feed on all kinds of creatures,



THE SINGULAR ISLAND OF SAINT KILDA.

dead or alive, even pursuing the shoals of herrings on their way to and from the sea, and thinning their ranks. They plunge headlong on the fish, and snatch it from the waters.

It happens, now and then, that the gull does not succeed in carrying off the prey. The frigate-bird, if he chance to be near, will take a fancy to the fish himself. He will dart upon the gull, and force him to drop it. Then, by a dexterous swoop, he will catch it in his beak and devour it. The gulls have all the fierce nature of the sea-birds, and it is not safe to be at their mercy.

Once it happened that a fishing-boat was upset near to the seaport town

of Yarmouth. All the men on board were drowned except one. He was a good swimmer, and tried hard to reach the shore, but the tide was against him, and he drifted out a long way from land. As he floated, exhausted, and almost hopeless on the water, he heard a flapping of wings. It was a party of sea-gulls coming to seize him for their prey. He could feel their wings touch his face, and he tried to strike at them with his arms, and drive them away. Happily, at this very moment a ship came in sight. He cried out with all his might, the man at the helm heard him, and soon after, a boat came to rescue him.

The family of the gulls is a very large one, including all kinds of varieties. There is the black gull, the herring gull, the Iceland gull, and many others; and there is the green-billed gull, or the sea-mew; the sea-mew has a hoarse, harsh voice, between a laugh and a scream; on wild rocky coasts the strange note of the bird is often heard.

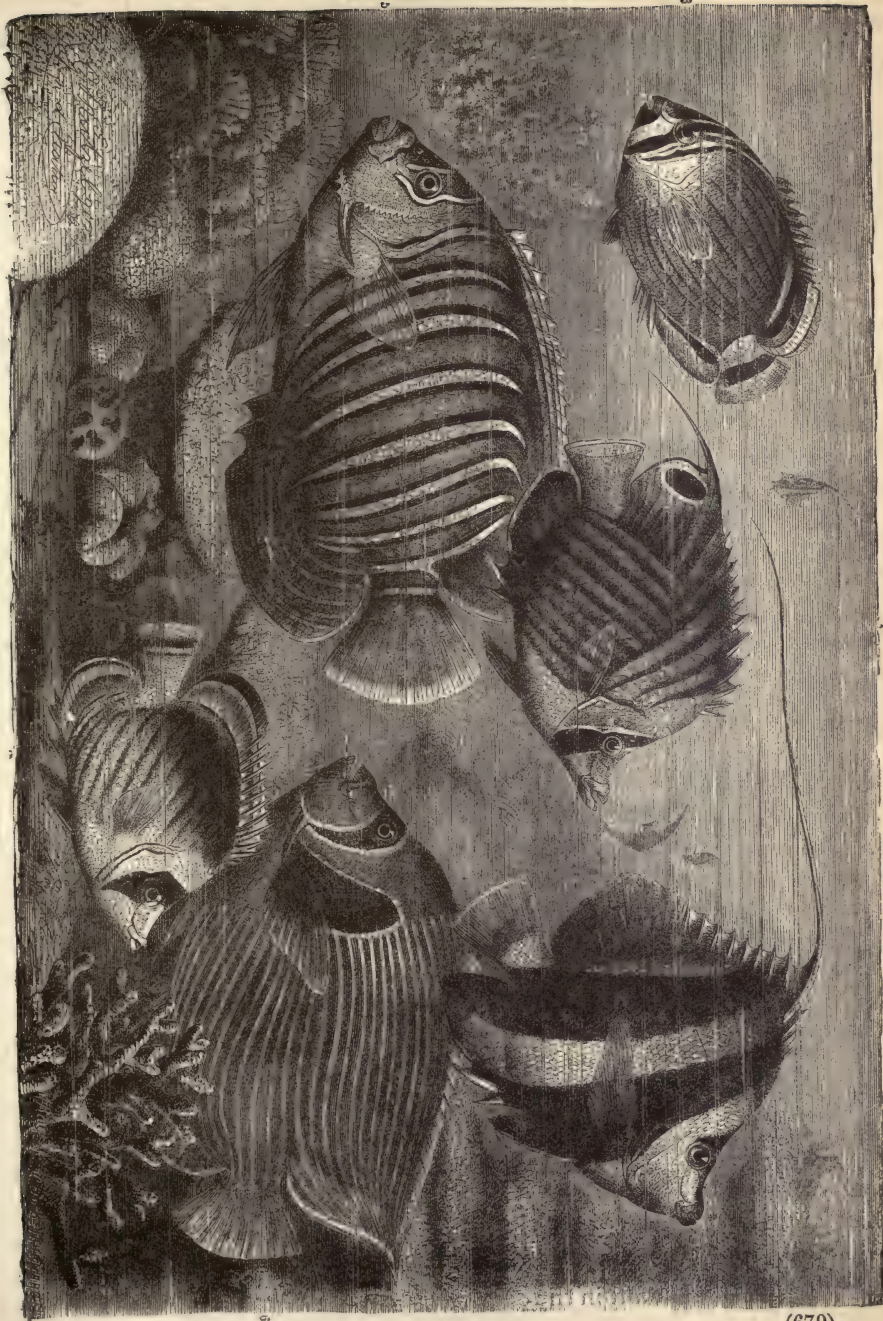
A Bleak Bird-Station.

Ocean birds have places of resort where they are sometimes found in immense numbers. Saint Kilda is an island which is only six miles round. Great rocks shoot up all along the coast, and there is only one place where people can land. Indeed, they cannot land at all unless the weather happens to be fine. It is one of the group of islands on the coast of Scotland, called the Hebrides. There is one rock, or precipice, which is the highest in all Britain; the view from the top is grand. Far below, the white foam of the ocean dashes about; you are thirteen hundred feet above the level of the sea.

In this wild lonely spot the sea-birds love to dwell, and the bare naked rock is covered with them; the air is darkened by them; the waves below are alive with them. Every narrow ledge is crowded with birds. If you were to roll down a stone, a strange confusion would happen. Down it would go among the thousands of birds sitting on their nests, and clouds would fly out and darken the air. But when the stone reached the bottom of the rock, and lay there quite still, the panic would be over. The frightened birds would come back to their nests, and begin to sit again.

There is the great auk, which is a little like the penguin. The mother auk does not sit on her eggs, but holds them close to her body till they are hatched. If she is disturbed, she waddles away, taking her eggs with her. Her mate all the time is very busy. He goes fishing every day, and brings her home plenty of food. When the young bird is hatched, both parents fish for it, and it gets so fat that it can hardly stir. But the parent birds get thin with the hard work they are doing. There are a great many gulls at Saint Kilda. One of them is called the kittiwake. If

SPECIMENS OF CURIOUS FISHES.



you go near the nests of the kittiwakes, they will all fly out, and begin to cry "Kitti-wake! Kitti-wake!" till you are nearly deafened.

Saint Kilda is not a pleasant spot to live in. The wind blows so fiercely that people cannot build houses more than four feet high. If they did, the house would be blown down. They make as much room as they can, by digging into the ground, but it is like living in a cellar. They have no windows, but only holes in the roofs of their houses. And there are little places round the walls, something like ovens to look at; these are the bedrooms. There are not more than a hundred people living on the island. They are not unhappy, though the place is so dreary. They keep a few sheep, to eat the patches of grass which grow here and there among the rocks. And in one place, which is a little sheltered from the wind, they can till the ground. But their great riches are on the ledges and among the crevices of the rocks. Here live the birds of Saint Kilda, including the fulmar, which give them food, and light, and medicine, and warm beds to lie upon in the cold winter nights.

Humming Birds of the Sea.

There is one class of fishes which must be mentioned on account of the peculiarity of their fins and their beautiful colors. The technical name of them is the *chætodon*; a name at once descriptive and more readily comprehended would be scaly-finned. The head and mouth of the *chætodon*, or scaly-finned fishes, are small, and they have the power of pushing out and retracting the lips so as to make a tubular orifice. The teeth are mostly bristle-shaped, flexible, moveable and very numerous. The gill membrane has from three to six rays. The body is scaly, broad and compressed, and the fins are generally terminated with prickles.

The reader will observe in the annexed engraving six specimens of *chætodons*. Their names, as numbered in the illustration, are as follows: 1, the flag fish; 2, the coral fish; 3, the rock fish; 4, the whip fish; 5, the duke fish; 6, the emperor fish.

In beauty and variety of colors the scaly-finned fishes are not inferior to the most beautiful birds or butterflies. On account of their brilliant colors they can be called the humming birds of the sea. Rings, stripes, spots of the most intensive blue, purple and velvet black, gold and silver, pink, in short all the colors of the rainbow are represented. This fish feeds principally on insects that hover about the water it inhabits.

The flag fish frequents the Red Sea, the Indian Ocean and the Western part of the Pacific Ocean. Its colors are black, white and orange yellow. The coral fish is found in the ocean between the Red Sea and the Chinese waters. White, black, yellow and pink are its hues. In the rock fish



THE SHOOTING-FISH CATCHING A BEE.

white, black, lemon yellow and orange are represented. It frequents the ocean between Eastern Africa and Otahaiti. The whip fish is found in the Indian Ocean. Its colors are yellowish gray, black, and silver white with lemon-yellow fins.

The duke fish and the emperor fish (*chætodon dux* and *imperator*) also frequent the Indian Ocean. Their colors are black, white, gray, yellow, deep blue violet and greenish brown. The shooting fish is found in Java, where it is kept in tubs and aquaria for pleasure. The flesh of this species is white and savory. The bat *chætodon* found near Ceylon is a large species with very broad fins.

The Sharp-Shooter of the Sea.

One of this species is the shooting fish. When it sees a fly at a distance on any of the plants in the shallow water, it approaches very cautiously, coming as much as possible perpendicularly under the object, then putting its body in an oblique direction with mouth and eyes near the surface, it remains for a moment immovable. It then shoots a drop of water from its snout with such dexterity that, though at the distance of several feet, it seldom fails to bring the fly or bee into the water.

In countries where this fish abounds, it is frequently kept in vessels of water, and affords much entertainment by the dexterity displayed in shooting at the flies, which are placed on the vessel for the purpose; it generally approaches to within five or six inches before the drop of water is ejected. A Javanese species exhibits the same curious instinct. It has a wide mouth, with a lower jaw considerably projecting; it throws a large jet of water with such force and precision as almost invariably to bring down a fly at the distance of two or three feet.

The Frog Catcher or Doko.

The African lung-fish has two lungs and is probably a connecting link between the vertebrata and the leptocardii. It is found in the White Nile and its tributaries, generally in the mud. During the dry season it buries itself in holes three or more feet deep, which it digs itself, and leaves its hiding place at night to catch frogs and crabs, which are its main food. During the rainy season it builds long walks or grooves in the mud. Its movements are rather slow and like those of a snake or a worm.

Dokos are seldom found in pairs; and are very quarrelsome. If they meet by accident, they forthwith commence fighting; the consequence of which is, that we rarely find a specimen whose tail is intact. If a man treads on its tail the doko shows fight, hisses like a snake and tries to bite. On account of its savory meat the negroes kill it either with spears or catch it with hook and tackle.

If the water, which the doko has chosen for its habitation becomes dried up, it wraps itself in a kind of a capsule of mud and remains there during the dry season. Living dokos have been brought to Europe in such a state. How long they sleep is not known, but it is a fact that they can remain in this condition for several months without injury. As soon as one of these capsules is put in water of the temperature of middle African rivers the doko shows signs of life; it commences to move, first as if it were drowsy, but after an hour it becomes lively, al-



THE DOKO OR SALAMANDER FISH.

though it seeks dark places and generally remains at the bottom of the basin. After a few days hunger makes itself felt, and then it pays attention to every movement near the surface of the water in the hope of capturing some prey. Meandering, it comes to the surface, takes the piece of meat or the frog offered and returns to its former place. Dokos have been kept for several years at the aquaria of London and Berlin.

If there is a fish, which deserves the name of climber, it is the mud-jumper, or mud-puppy. Its pectoral fins seem to be constructed to enable it to climb. These fins are more like feet than fins, and are gener-

ally used like feet. The mud-puppies live more in and on the mud than in the water. They hunt for their prey on land, mostly lay, like salamanders on the mud, run around like the lizards and fall upon their prey so suddenly that they very seldom miss it. If they are threatened by an



THE MUD-JUMPER OR CLIMBING FISH.

enemy they shoot across the mud like an arrow, bury themselves in it and hide themselves in that way. They often climb up the roots of mangrove trees and are able to remain out of water for several hours.

The superintendent of the Natural History Department of the Crystal Palace, London, received from Western Africa four blocks of hard, dry,

muddy clay, sewn up carefully in a canvas wrapper. The directions were that they should be placed in a tank of fresh water, at the temperature of eighty-three degrees. This was done, and in a short time the clay became softened, and crumbled away, and the inner case or cocoon, in which a climbing fish was inclosed, floated motionless to the surface. This case, or cocoon, is probably nothing more than the layer of mud mixed with the mucous exuding from the body of the creature. The cavity is moulded by the coiled-up body, and often, perhaps usually, bears the impression of the scales.

It was not long before this cocoon became agitated: it was evident that the fish was endeavoring to extricate itself; a few struggles, and it had burst away; immediately it began to swim about, and then diving into the mud at the bottom of the tank, sheltered itself from further observation. The next morning two more emerged from their cocoons, and in the course of the following day the fourth of the party floated to the surface, but it was dead.

The three living ones were supplied with earth worms, small frogs, fish, and occasionally with raw flesh, and began very eagerly to feed. They did not, however, live together in peace, for they were seen at times to assault each other. One of them, probably in an effort to escape from its antagonist, leaped out of the tank, and got into the large fountain-basin, where it remained among the gold-fish and the water-lilies. The two others lived on for some time, apparently agreed, when it was suddenly discovered that only one survived, having actually killed its companion, and, with the voracity of a cannibal, had left only the head and some part of the body, probably that which it liked least, undevoured. In three months it grew rapidly, actually doubling its length.

Death of the Fish-Cannibal.

It was now transferred to the basin from which the other—the companion of the lilies and gold-fish—was withdrawn, and placed again in the tank, where it suddenly died; and thus the destroyer of his fellow alone survived. Here it continued to thrive at liberty, but was rarely seen, and when observed near the surface, it was apparently sick, and finally was taken out dead. The exterior of the animal has been carefully preserved, and may be seen by any visitor to the Reptile Department of the British Museum. This creature masticates the food much, frequently putting it forward, almost quite out of its mouth, and then gradually chewing it back again. It rises frequently to the surface of the water to breathe, and at other times supports itself on its fin-like appendages, and with the

aid of its tail, raises its body from the ground, the fins being bent or curved backwards.

The movement of this animal is generally very slow, and would give one an idea that it was very sluggish ; this, however, says a well known naturalist, I have good reason to know is not the case, as, in attempting to capture the one at liberty in the large basin, it darted away with the rapidity of an arrow. I have reason also to believe that the animal finds its food as much by scent as sight. With reference to the cocoon, the end covering the nose of the animal is rather pointed, and has an aperture about the size of a pin's head, which I have no doubt enables it to breathe during its state of torpor. The animal, when in its case, is coiled nearly twice round ; and I observed in each of the blocks of clay a small hole, about the size of a mouse-hole, which was quite smooth on the inside, as though the fish had crept through it.

The Savory Shad.

The American shad is one of the most abundant of our American fishes, and is held by many authorities, among them Frank Forester, as "the most delicate of existing fishes," though its numerous sharp bones are an admitted drawback. It is from one to two feet long, appears along our coasts in the spring, and entering the rivers, ascends them for the purpose of depositing its spawn along the banks. At this season they are caught in large numbers by nets. They will also take the hook bated with a gaudy fly, and afford good sport to the fisher. Those of the New England rivers are deemed the best, those of the Connecticut taking the first rank. They are eaten fresh, and are also extensively put down in barrels. When this country was first settled they were more abundant than at present, and afforded the natives a large part of their subsistence. At that period the salmon was very abundant in the northern rivers, and less esteemed than the shad ; it was therefore customary for the fishermen, who caught both kinds in their seines, to require the people who came down from the country to buy shad, to take a certain portion of salmon.

The American alewife, is eight to ten inches long, appears like a small shad, and was formerly held in New England to be the young of that fish. It is taken in considerable numbers with the shad, and has similar habits ; it is put down in barrels, and commands a good price.

CHAPTER V.

BUTTERFLIES OF THE OCEAN.

Beautiful Dwellers in the Sea—Fishes with Wings—Both Water and Air their Elements—Alighting on Ships—Curious Formation of Fins—The Flying Gurnard of the Mediterranean—Sailing Through the Air—Mounting on Wings to Leave Enemies Behind—Prey for Sea-Gulls—Swallows of the Ocean—The Growling Gurnard—Strange Noises—The Gurnard's Greediness—The Marvelous Red Fire-Fish—The Terror of Arabian Fishermen—The King-Fish—Great Size and Beauty—Savory Meat—The Drum-Fish—An Orchestra in the Sea—Narratives by Humboldt and Tennent—Tinkling Sounds of Great Sweetness—Paradise Fish and its Singular Habits—A Haughty Male and His Brutality—The Sea Butterfly—The Bridegroom—Winged Insects of the Deep.



HERE are beautiful creatures in the great deep with colors as gorgeous as those of butterflies; moreover, like butterflies, some of them have wings and rise like birds from the surface of the sea. The flying fishes, when in their own element, are constantly harassed by various fishes of prey, and it is supposed that their flights are performed for the purpose of escaping from these enemies; when in the air, however, they are subject to the attacks of various species of gulls.

Whether these fishes possess the power of flying, in the true sense of the term—that is, by beating the air with their members—or whether their large fins merely serve as parachutes to sustain them in the air for a time, after a leap from the water, is not yet fully ascertained, observers having given different accounts. The latter is, perhaps, the prevailing opinion of naturalists, and is that of the more recent investigators.

I have never, says Bennett, the naturalist, been able to see any percussion of the wings during flight, and the greatest length of time that I have seen this volatile fish on the fin has been thirty seconds by the watch, and their longest flight mentioned has been a few hundred yards. The most usual height of flight, as seen above the surface of the water, is from two to three feet; but I have known them come on board ship at a height of fourteen feet and upwards; and they have been well ascertained to come into the the channels of a line-of-battle ship, which is considered as high as twenty feet and upwards. But it must not be supposed they have the power of elevating themselves in the air after having left their native element; for, on watching them, I have often seen them fall much below

the elevation at which they first rose from the water, but never, in any one instance, could I observe them rise from the height at which they first sprang; for I regard the elevation they take to depend on the power of the first spring or leap they make on leaving the water.

Judging from the foregoing and similar accounts, it would appear that something beyond the mere leap of the fish would be required to account for such great heights as fourteen or twenty feet, at which these fishes have been seen. If they cannot fly, as might be supposed on examining the structure and position of their fins, it seems probable that they take advantage of the wind at times, and so adjust their fins as to be carried upwards by it. Two species are very abundant—the former in the Mediterranean Sea, and the latter in the Atlantic Ocean.

The common flying fish is twelve to fourteen inches long, and has the ventral fins placed anterior to the middle part of the body; it may thus be distinguished from the flying gurnard of the Mediterranean, which has the fins placed behind the middle of the body. These fins are also much smaller in the true flying-fishes. The species now under consideration belongs to the Atlantic, and is most common in the tropical portions, though occasionally found on the European and North American coasts. They are often seen to leap by hundreds and even thousands from the water, chased by other fishes. They have the power of flight by beating the air and rising upon it with their fins, and sail along, sustaining and prolonging their course by spreading their fins. They rise into the air by vigorous leaps, and occasionally have fallen on the decks of ships.

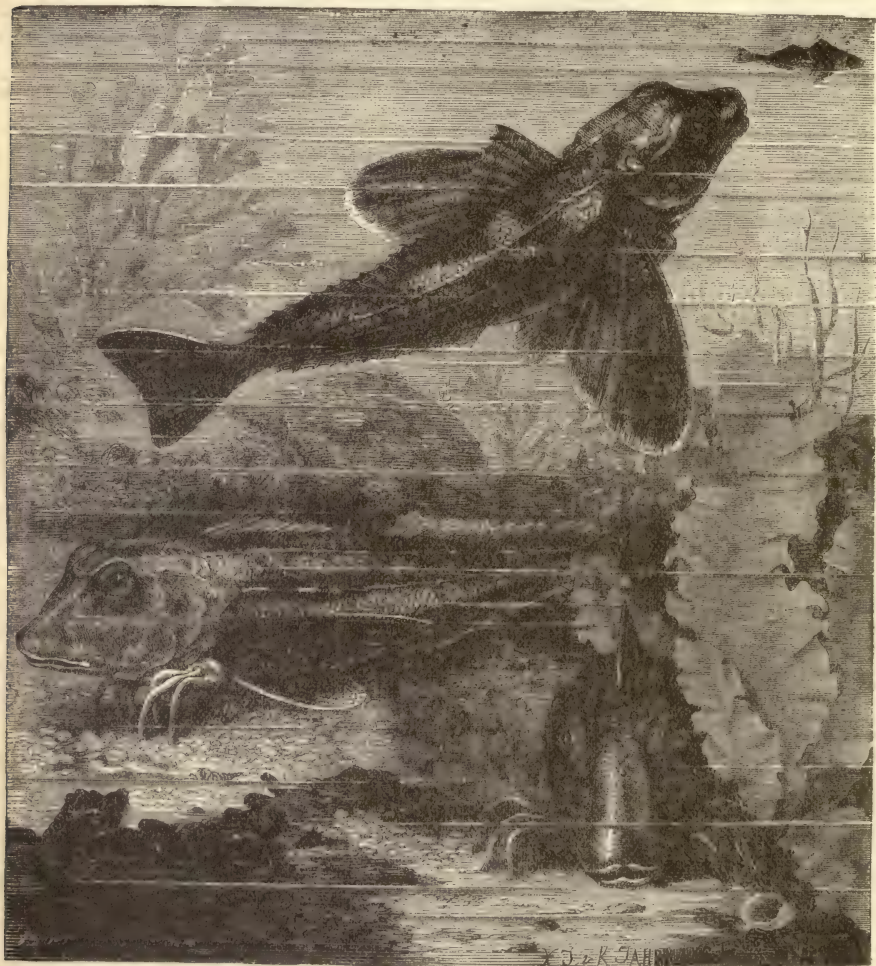
The Flying Gurnard.

The flying fishes generally inhabit the seas of hot climates; but they are occasionally found within the temperate regions. The flying gurnard inhabits the Mediterranean Sea. The flying fish has numerous enemies in its own element and to aid its escape, it is furnished with its long pectoral fins, by means of which it is able to raise itself into the air, where it is often seized by the albatross and the sea-gull. Its flight is short, about a hundred yards, but by touching the surface of the sea at intervals to moisten its fins and to take fresh force and vigor, it is able to greatly increase this distance.

Flying fishes are seldom seen to rise singly from the water; they generally appear in large shoals. Navigators in all tropical seas are familiar with these sprightly fishes, which relieve the monotony of ocean life as birds do the silence of the forest. The character of the long pectorals, the strength of the muscles which move them, and the size of the long



arch, to which they are attached, are the essential conditions of their flight. The common flying fish of the Mediterranean is rarely more than sixteen inches long, and is found in all parts of that sea. There are five species on the coast of North America.



GURNARDS OR FISHES THAT GROWL.

The eyes of these fish are so prominent, as to admit of their seeing danger from whatever quarter it may come, but in case of emergency, they are able to push them somewhat beyond the sockets, so as to considerably enlarge their usual sphere of vision. They are frequently either unable to direct their flight out of a straight line, or they suddenly be-

come exhausted, for sometimes whole shoals of them fall on board of ships. They have somewhat the manner of the swallow in the air, except that they fly in straight lines, and their black backs, their white bellies, and their forked and expanded sails, give them much the same appearance as that of these birds.

The Growling Gurnard.

The gurnards, or sea-cocks, have always attracted attention on account of the grumbling noise which they make when taken out of the water. They are carnivorous and predatory fishes. They inhabit the North Sea and the Baltic, but are also found in various other parts of the ocean. Their weapons of defence are their sharp dorsel fins, with which they attempt to inflict a wound. The grumbling noise they produce by compressing their bodies and expelling the air through their gills.

They chiefly reside in the depths of the sea, where they have a plentiful supply of food in crabs, lobsters and crustaceous animals. While it is in the water, the colors of the gurnard are brilliant and beautiful, especially in the broad sunshine, as they then vary with every motion of the fish. It is very voracious, and devours almost everything eatable that comes in its way.

A Fish with Fiery Colors.

The most beautiful fishes, as far as colors are concerned, are the pterivides, although their form, especially the head with its prickles, gills or spires, has no claim to beauty whatever. About twenty-two bands, of a pink hue, run in pairs and nearly parallel to each other across the body, while, where the breast fins are connected with the body there is a large white spot. Similar white spots are distributed on the fins. This fish is found all over the Indian Ocean, from the coast of Africa to Australia. The red fire-fish is not a flying fish, neither is it a fast swimmer; the points of its finbones easily break off, and for that reason the fish is greatly feared by the Arabian fishermen.

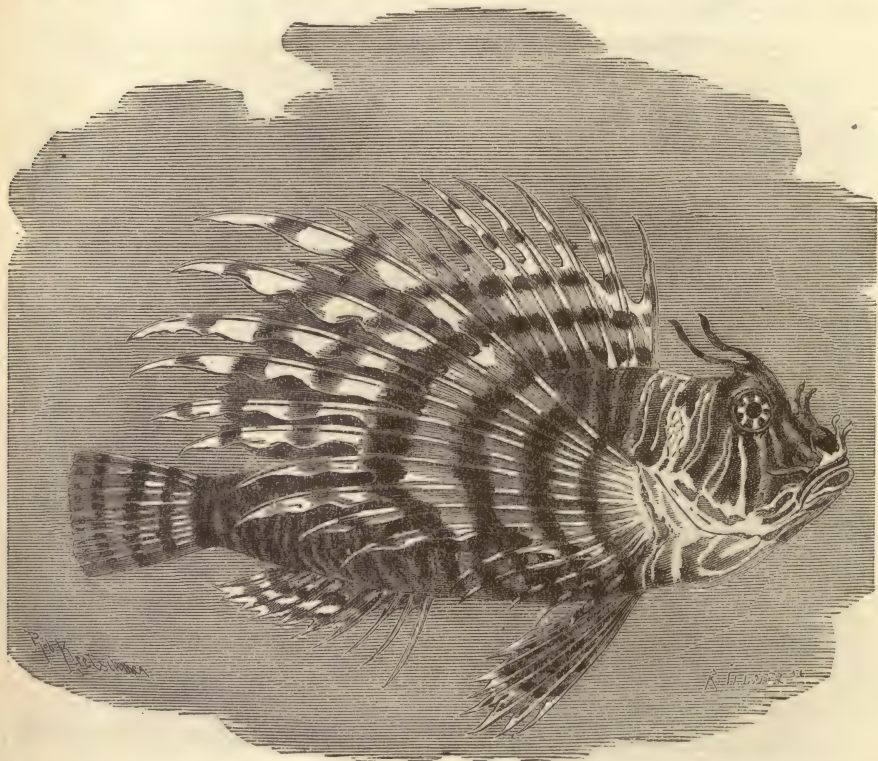
The Opah or King-Fish.

The opah is one of the most beautiful specimens of the varieties we are considering. Under favorable circumstances it attains a length of six feet and a weight of nearly two hundred pounds. It is one of the most beautiful fishes in existence, steel-blue, violet and pink hues being prevalent. Its flesh is very savory, being considered as good as that of salmon. The Icelanders value it on account of its alleged great medicinal qualities.

The Drum-Fish.

As we have already described the gurnard, or growling fish, it will be interesting to the reader to take a glance at another tenant of the sea,

which is also remarkable for the sound it produces. The gurnards are wonderfully colored, but the drum-fish surprises us by the singular sound it makes. This fish, the maigre, is most abundant along the southern side of the Mediterranean, but is taken off the shores of Spain, France, and Italy. The maigre is gregarious in its habits, swimming in shoals, which utter a purring noise so loud as to be heard from a depth of twenty fathoms; and from this circumstance, the fishermen are often enabled to



THE RED FIRE-FISH.

take several in their net with certainty, their noise betraying their exact locality. Their capture, however, is not a very safe or easy task, for the maigre is from three to six feet and upwards in length, very strong and resolute, and it struggles with the utmost desperation, knocking the men about, till one of them can manage to strike it a heavy blow on the head, and so deprive it of life. It appears always to have been in great request with epicures; and as, on account of its large size, it was always sold in pieces, the fishermen of Rome were in the habit of presenting the head,

which was considered the finest part, as a sort of tribute to the three local magistrates, who acted for the time as conservators of the city. It is the umbrina of the ancient Romans, and is of a general silvery gray, inclining to brown on the back, and pure silver on the under parts.

Allied to the maigre are some fish remarkable for their great size, and the noise they send forth, and which has led to their being called "drums." According to Mitchill, it is when they are taken out of the water that they send forth this noise; but Schoepf says that it is under the water; that



THE OPAH OR KING FISH.

this noise is dull and hollow; that several individuals assemble round the keel of ships at anchor, and that then their noise is most sensible and continuous. This account may seem extraordinary, yet it is perfectly conformable with the following statement: Lieutenant White relates, that being at the mouth of the river of Cambodia, his crew and himself were astonished by some extraordinary sounds which were heard around the bottom of their vessel. It was like a mixture of the bass of the organ, the sound of bells, the guttural cries of a large frog, and the tones which

imagination might attribute to the largest harp; one might have said the vessel trembled with it. These noises increased, and finally formed a universal chorus over the entire length of the vessel and the two sides. In proportion as they went up the river, the sounds diminished, and finally ceased altogether. The interpreter told Lieutenant White that they were produced by a troop of fishes of an oval and flattened form, which have the faculty of strongly adhering to various bodies by the mouth.

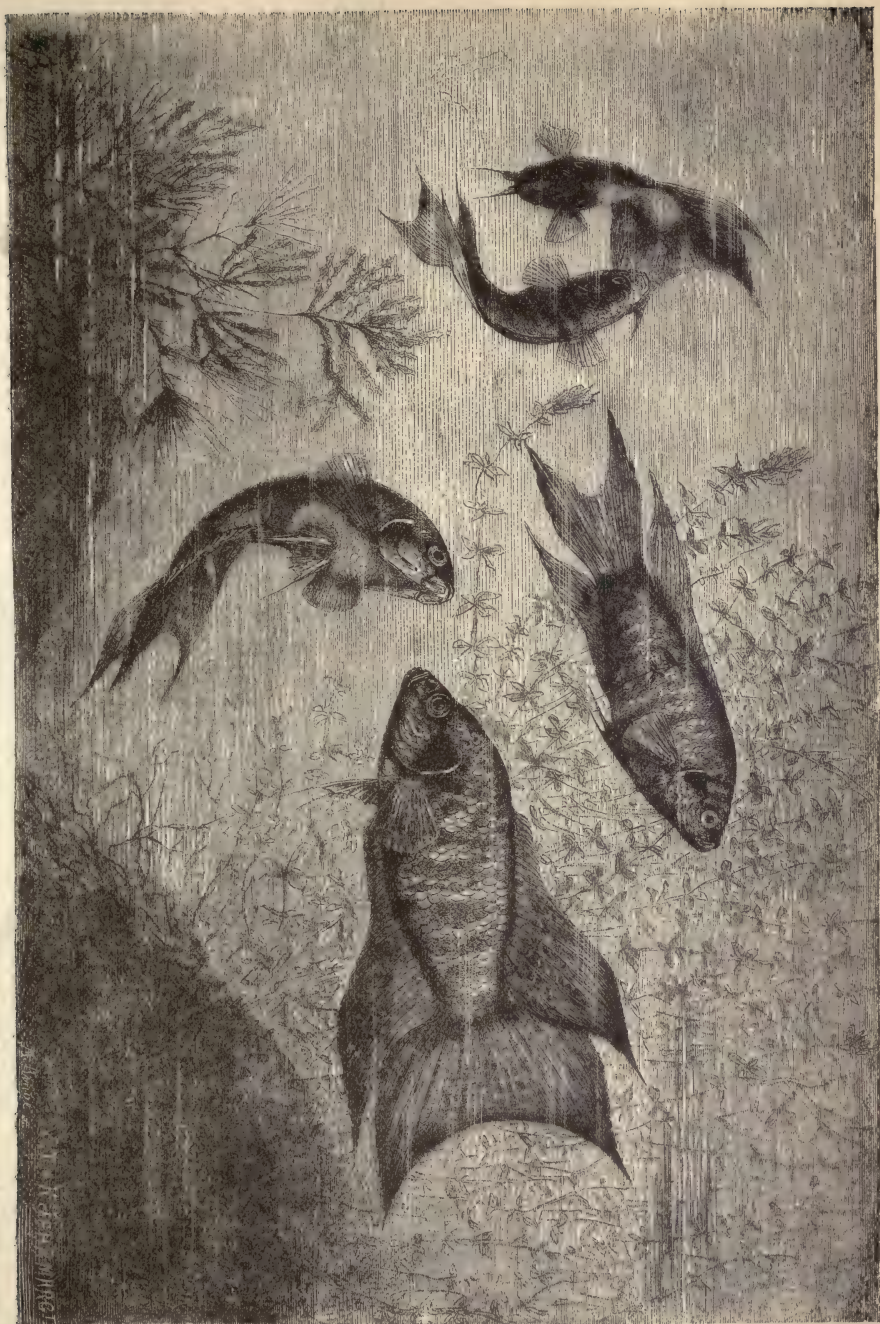
Strange Noises Heard on Shipboard.

Humboldt met with a similar fact, but without suspecting the cause. One evening, towards seven o'clock, the whole crew were astonished by an extraordinary noise, which resembled that of drums beating in the air. At first it was attributed to the breakers. It was like the noise of the air which escapes from fluid in a state of ebullition. Those on board began then to fear there was a leak in the vessel. The noise was heard unceasingly in all parts of the ship, till about nine o'clock it ceased altogether. The drums, according to Mitchill, swim in numerous troops, in the shallow bays on the south coast of Long Island, where the fishermen find them during the summer. Schoepf says that they are found in still greater abundance, and during the whole year, along the coasts of the Carolinas and Florida.

Some other creatures, having a similar power, are alluded to by Sir Emerson Tennent. He states that when visiting Batticaloa, on the north of Ceylon, he made inquiries relative to the musical sounds alleged to issue from the bottom of the lake. The fishermen vouched for the truth of the story, stating that the sounds are heard only during the dry season, and cease when the lake is swollen by rains. In the evening, says Sir Emerson, when the moon had risen, I took a boat and accompanied the fishermen to the spot. We rowed about two hundred yards north-east of the jetty, by the fort gate. There was not a breath of wind, and not a ripple, but that caused by the dip of our oars; and on coming to the point already mentioned, I distinctly heard the sounds in question.

They came up from the water like the gentle trills of a musical chord or the faint vibrations of a wine-glass when the rim is rubbed with a wet finger. It was not one sustained note, but a multitude of tiny sounds, each clear and distinct in itself; the sweetest treble mingling with the lowest bass. On applying the ear to the wood-work of the boat, the sound was greatly increased in volume by its conductor. They varied considerably at different points as we moved across the lake, as if the number of animals from which they proceeded was greater in particular spots; and occasionally we rowed out of hearing of them altogether,

FAMILY OF PARADISE FISHES.



until, on returning to the original locality, the sounds were at once renewed.

The beautiful paradise fish, which in China is kept, like the gold fish, in aquaria, is one of the most interesting of the finny tribe. They spawn in captivity much more readily than gold fishes.

For experiment two females and one male were put in a tank. The former soon selected for themselves certain corners, where they received the visits of the male. Soon the females commenced to play with each other. When the male approaches the female it spreads its tail and fins, as can be seen in our illustration, and takes a darker hue, while the female adopts a nearly perpendicular position, holds up its fins as far as possible,



THE SEA-BUTTERFLY.

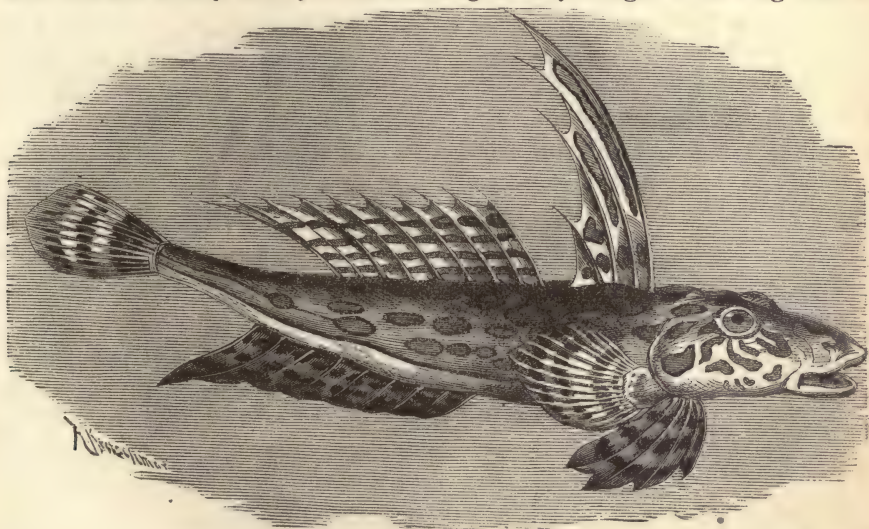
and turns around on its own axis, after the male takes a similar position, but in the opposite direction as the left part of our illustration shows. In this case they playfully turn around each other, and the male trembles; often the female imitates these trembling motions.

Sometimes a disagreement occurs between the male and female, and then the male treats the latter in a most cruel and brutal manner, biting her fins, tearing out her eyes and even killing her. The paradise fish is of a reddish and greenish hue.

In the Mediterranean, wherever the coast is rocky, the sea-butterfly is never missed; it is occasionally found in the Atlantic Ocean. Its flesh is without a taste and is therefore only eaten by the poorer classes. The

head and fore-part are large, and somewhat blunt in appearance. It has a large dorsal fin, with a large colored mark like that of a butterfly; and other parts of the body are embellished with variegated colors, combining to make this one of the most remarkable of the finny tribes. It may properly be classed among the butterflies of the ocean.

Fishermen have given several names to another beautiful fish, one of which, the bridegroom, proves that they recognize its beauty. It is found in deep water; it very seldom leaves its regular place, and if it does so, it soon returns to it. Like the cat, it lays in wait for its prey, then suddenly attacks it, and never undertakes a second attack, if it misses the first time. The fish has a very savory meat and is generally caught with drag nets.



THE BRIDEGROOM FISH.

There are countless swarms of moths which come out, on a summer's evening, when it is getting dusk. They have lain hidden all day; but no sooner is the sun down, than myriads issue forth to look for prey. They are called night-flying insects.

There are some little creatures in the sea, that are very much like insects, and have the same habits as the moths; they have been called the winged insects of the deep. And another name has been given to them; they are called wing-footers, because they whirl about, as if they had wings. These wings are two fin-like flaps, which proceed from the foremost part of the body. In reality the flaps are only one organ. A bundle of muscular fibre passes through the neck, and spreads out at each side like a paddle.

These little creatures have no foot to creep on, or arms to seize their prey. But they have a distinct head, as the cuttle-fish has. Sometimes the head is hidden in a thin transparent shell. When the animal is alarmed, it draws its wings, and, indeed, its whole body, into the shell. But though the wing-footer seems to sport about, and be so innocent and harmless, it is furnished with an array of weapons that can scarcely be surpassed. Let us take one of the tribe—the little clio, on which the whale feeds—and look at it through a microscope. What are those six feelers that project from its head? And why are they of that red and speckled hue? Look more closely, and you will see that a number of tiny points are dotted all over them. There may be thousands of these points. Each point or speck is a sucker, like that of the star-fish. And it can be pushed out, and can seize hold of its prey in the same manner. When the little clio does not want its weapons, it draws them in, and they lie hidden and protected by a kind of sheath that covers them.

Look a little further, and you will see a mouth furnished with sharp horny teeth, that have a metallic lustre, and shine in the sun. The tongue has hooked spines on it, that curve backwards, like those of the cuttle-fish, and help to drag the food down into the stomach. The merry little clio is terribly armed, and when twilight comes, hosts of these little creatures whirl about in search of prey. They dance merrily on the waves, sinking and rising, and seeming to be full of gambols. The sea is alive with them, but their gambols do not last long. Before the morning dawns, they have disappeared, and no trace of them is to be seen.

CHAPTER VI.

SINGULAR VARIETIES OF FISHES.

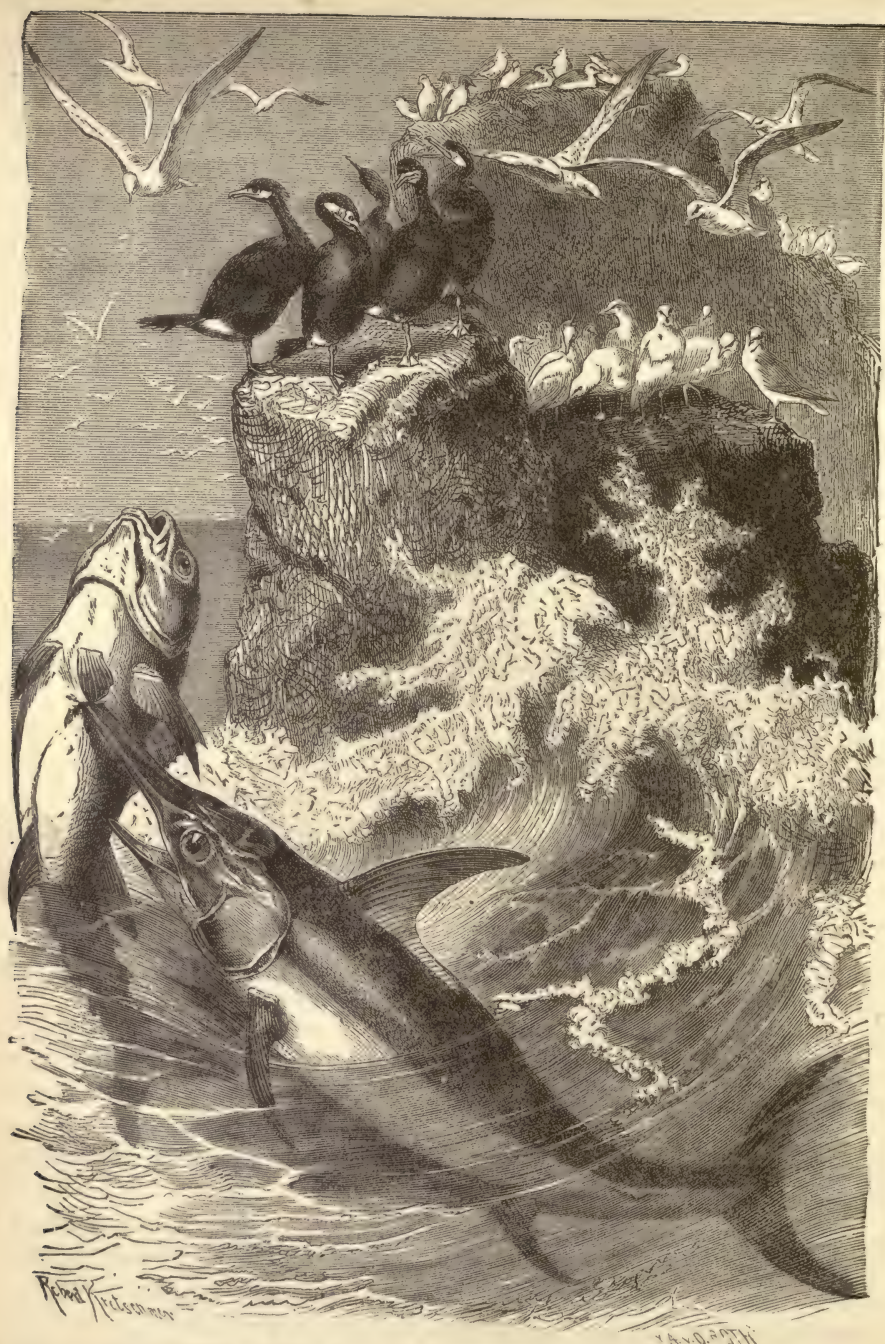
Amazing Contrasts in Ocean Life—The Great Sword Fish—Vast Size and Power—A Creature Armed for Destruction—Formidable Weapon of the Sword Fish—A Sword Left in the Timber of a Ship—The Whale's Great Enemy—The Ocean Bat—Peculiar Attitude in the Water—Arms and Fins Combined—A Creature of Hideous Ugliness—The Slender Pipe Fish—The Needle of the Sea—Strange Pouch for Carrying Eggs—Color of the Pipe Fish—A Dried Curiosity—Sea-Horse—Body Clad with Mail—Tail that Grasps—Short-Nosed Hippocampus—Peculiarities of the Short-Nose—The Skate—An Enterprising Digger—Elegant White Fins—The European Sting Ray—A Bag for the Infant Fish—The Sea-Devil—A Fish that Angles—Singular Method of Capturing Prey—The Extraordinary Tape Fish—A Beautiful Marine Animal—Great Length of the Tape Fish—The Sea-Cat—Silvery Color—Wonderful Healing Oil—Flat Fish—Turbot—Plaice—Flounder—Sole—Spiny Sea-Porcupine—Globe Fish—Sun Fish—The Sturgeon—An Ocean Delicacy—A Fish Fond of Mud.



One can examine the forms of life in the mighty ocean without being impressed with the marked varieties and contrasts constantly presented. Fishes of every shape, size, and manner of existence, have engaged the attention of the naturalist, and here, as everywhere in the great realm of nature, the farther he pursues his investigations the more wonderful do the discoveries become. One of the singular creatures of the sea, concerning which a volume might be written, is the sword-fish.

Sword-fishes are very large and powerful animals; they often grow to the length of twenty feet and more. They are very voracious and attack and destroy almost every living thing that comes in their way. They belong to a family of marine spiny-rayed fishes, allied to the mackerels, and are so called from the prolongation of the snout into a long horizontally flattened sword-like weapon. The sword consists of a long, strong bone, projecting from the nasal part of the head, and is capable of doing immense damage to any animal which is so unfortunate as to cross the path of this savage monster of the sea.

The common sword fish is found in the Mediterranean and on both sides of the Atlantic; it uses its sword to destroy its enemies and sometimes strikes at vessels, burying its weapon deep in their timber. When the British ship "Leopard," after her return from the coasts of Guinea and the West Indies, was being refitted and cleaned, the ship-



wrights found in her bottom, pointing in the direction from the stern towards the head, part of the sword or snout of one of these fishes. On the outside it was rough and the end, where it was broken off, appeared like a coarse kind of ivory. The fish is supposed to have followed the ship when under sail. The sword had penetrated the sheathing, which was one inch thick, had then passed through three inches of plank, and beyond that four inches and a half into the timber. The force requisite to effect this must have been very great, especially as the shock was not felt by the persons on board.

A few years ago the captain of an East Indiaman reported another instance of the wonderful strength which the sword fish occasionally exhibits. The bottom of his ship had been pierced through in such a



THE SEA-BAT.

manner that the sword was completely imbedded and the fish killed by the violence of the effort.

The sword fishes and the whales are great enemies. They never meet without coming to battle. Sometimes two sword fishes make common cause against a whale, and the battle often lasts until the sword fish loses sight of the whale, which is at length compelled to swim off, his superior agility enabling him to do this. In the sword-fish piercing the whale's body with its sword, it seldom does great harm to the animal from not being able to penetrate much beyond the blubber.

The above illustration does not represent the peculiar attitude, which

the bat-fish assumes when upon the sea-bottom, for which its feet or flipper-like pectoral fins well adapt it. This attitude is somewhat like that of a frog, but the entire body is supported by the pectorals and balanced in an oblique position by the caudal fin. When the bats wish to move, they hop along from point to point by using the pectorals as feet, aided to a certain extent by the buoyant action of the surrounding water. When not upon the bottom they move about in a manner similar to other fishes, by the action of the caudal fin, balancing themselves by movements of the pectorals.



PIPE FISH AND SEA-HORSE.

This animal is one of the ugliest of the finny tribe. It belongs to the family of anglers or sea-devils. Its pectoral fins are attached to an upper arm. It is very voracious and its flesh is eaten by the poor along the coast of the Mediterranean.

About twenty species, to which these specimens belong, are described, of which in Europe the best known is the great pipe fish, sometimes called needle fish. In the male the posterior part is broader than the rest, with two soft flaps folding together and forming a kind of pouch for the recep-

tion of the eggs, which, it is believed, are placed there by the female. Its color is pale brown, transversely barred with darker brown. The serrated pipe fish attains a length of twenty-eight to thirty inches of which the caudal filament is ten or twelve inches. The color is light drab with a narrow brownish-blue band along the sides, the throat white and the sides silvery. It is found from Massachusetts to the coast of Brazil.

Fish Resembling a Horse.

This fish is one of the most common, and is often kept by the fishermen in a dried state to sell as a curiosity to seaside visitors. This species, says Couch, may be seen slowly moving about, in a singular manner, horizontally or perpendicularly, with the head downwards or upwards, and in every attitude of contortion, in search of food, which seems chiefly to be water insects. Yarrell observes, that these fishes are supposed to be able, by dilating their throat at pleasure, to draw their food up their cylindrical beak-like mouth, as water is drawn up the pipe of a syringe. The sea-horse is an osseous fish with tufted gills, of the family of pipe-fishes. The snout is prolonged and the head elevated posteriorly, somewhat resembling a horse's head. The body is mailed and spiry. The tail is without a fin and prehensile, and by means of it they suspend themselves to sea-weeds and other submarine objects. The eyes are prominent; the pouch, in which the mates carry the eggs till they are hatched, opens at the commencement of the tail. They exist in all parts of the temperate and abundantly in the tropical oceans.

Specimens of this fish have, it is said, been occasionally found curled up in oyster-shells; but of their general habits little is known: the following extract from Yarrell's work is therefore the more interesting: I had two female specimens of hippocampus, or sea-horse, healthy and active, which had been living twelve days in a glass vessel; their actions being equally novel and amusing. An appearance of search for a resting place induced me to consult their wishes by placing sea-weed and straws in the vessel; the desired effect was attained, and has afforded me much to reflect upon in their habits. They now exhibit many of their peculiarities, and few subjects of the deep have displayed in prison more sport or more intelligence.

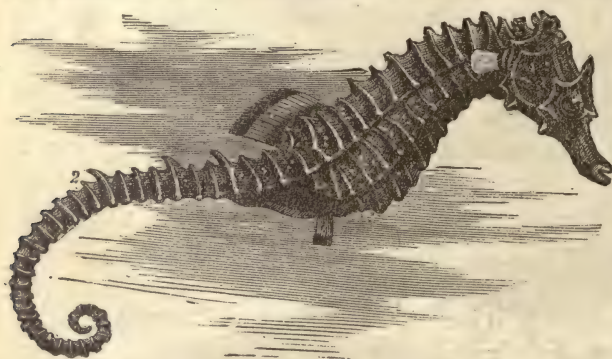
When swimming about they maintain a vertical position, but the tail is ready to grasp whatever it meets in the water, quickly entwines in any direction round the weeds, and when fixed the animal intently watches the surrounding objects, and darts at its prey with great dexterity. When both approach each other, they often twist their tails together, and struggle to separate or attach themselves to the weeds; this is done

by the hinder part of their cheeks, or chin, which is also used for raising the body when a new spot is wanted for the tail to entwine afresh. The eyes move independently, as in the chameleon; this, with the brilliant iridescence about the head, and its blue bands, forcibly remind the observer of that animal.

The ray, a cartilaginous fish, is popularly called skate. The smooth ray, or common skate, of the northern coast of America is of a uniform light brownish color above, and dingy white below. It attains a length of from three to five feet, and a weight of two hundred pounds, and is found from New York to the British provinces.

Its flesh is being extensively consumed, and the fleshy parts of the pectorals are said to be beautifully white and delicious. It feeds on fish, crustaceans and mollusks, and is very voracious. It digs up clams with its powerful spade-like snout, crushing them easily with its flattened

teeth. There are eight or nine species in European waters, some attaining a weight of several hundred pounds. Several species are common in the London market, where the females are known as maids.



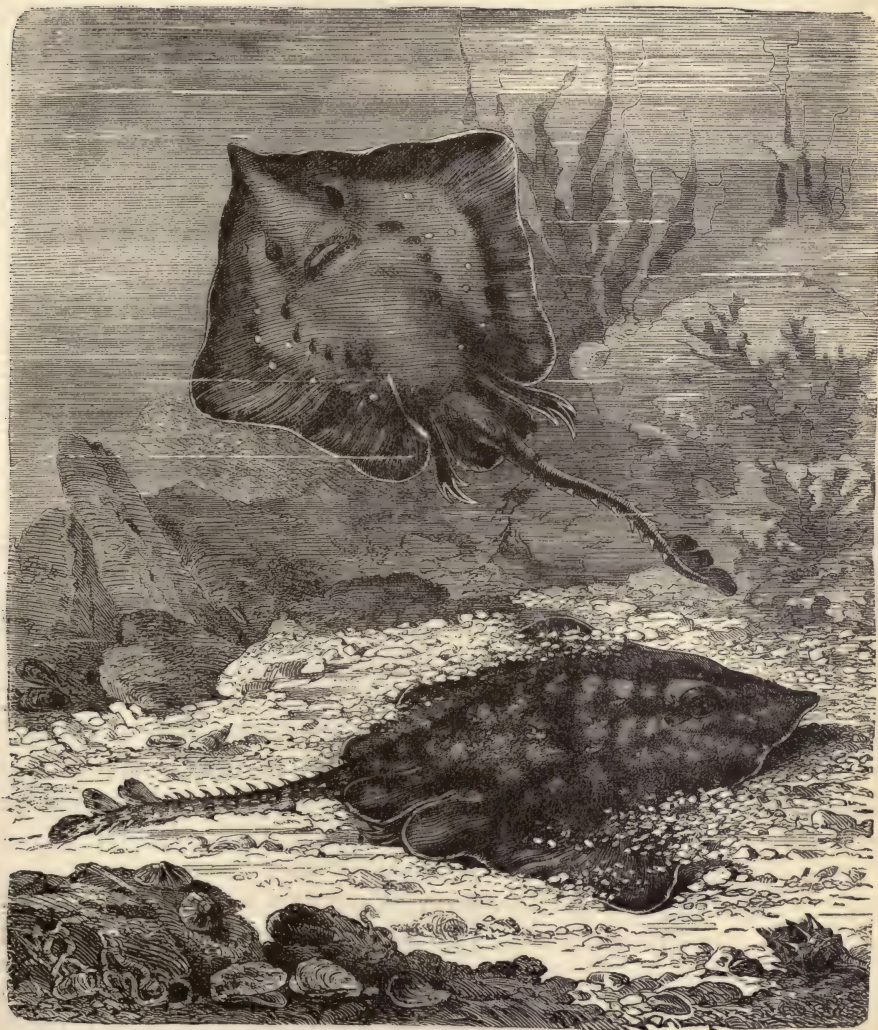
SHORT-NOSED HIPPOCAMPUS.

The American whip sting-ray occurs on the coast of the Middle States, and attains a length of from five to eight feet, including the tail. It is not uncommon on the shores of New Jersey, and is caught both by hook and seine.

The principal use made of this species and of all the rays in this country is to extract the oil from the liver, which is employed for various domestic and medicinal purposes. The European sting-ray is common in the Mediterranean and on the southern Atlantic coast. It twists its long tail around its prey and its enemies, causing very severe lacerated wounds. Its flesh is not eatable. From the month of May until the beginning of September the females are occupied in producing their offspring. This they usually do on crafts and in places where they are liable to little interruption. Each of the young ones is enclosed in an oblong angular bag, about half an inch thick in the middle. These are called purses by

the fishermen and after the fish have escaped, are frequently cast ashore by the tide.

The common angler, or fishing frog, also called the sea-devil, is taken in a calm from boats or vessels at sea, on the hooks of long lines, with a



THE SHARP-NOSED SKATE.

piece of dog-fish or a herring for a bait. This very curious fish is usually about three feet in length, but has been known to measure five feet. The head is wide, and the mouth nearly as wide as the head; the eyes are large, the pupils black; the lower jaw which is the longer, is bearded or

fringed all round the edge ; and both jaws are armed with numerous teeth ; the body is narrow, compared with the breadth of the head, and tapers gradually to the tail. The whole fish is covered with a loose skin. The color of the upper surface of the body is uniform brown ; the under surface of the body, the ventral and pectoral fins white, and the tail almost black.

On the top of the head are three long filaments ; of these, two are seated just above the muzzle, the other rises from the back of the head. These filaments are supported by bone, and movable in all directions, especially the first, which, tapering like the finest fishing-rod, ends in a broad, flattened, silvery tip. The pectoral fins are broad and thick, and serve the place of hind feet, for the ventral fins are placed far anterior to them on the body.



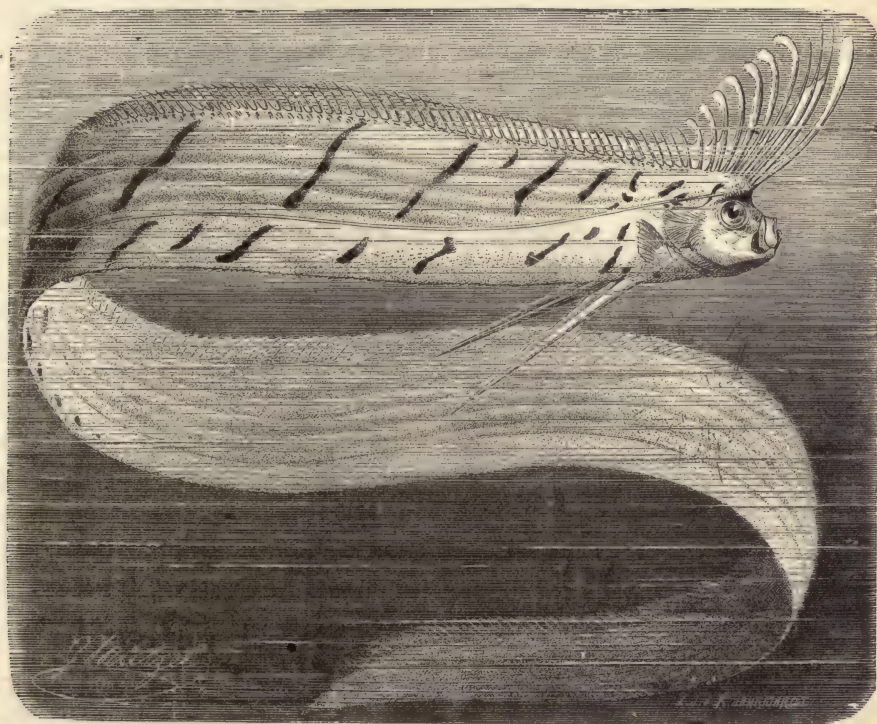
LOON IN THE JAWS OF AN ANGLER-FISH.

The angler is insatiably voracious, but it is a slow swimmer ; it is formed, in fact, for taking its prey in ambush. It reposes on the soft mud or sand, in some favorable lurking-place, and, stirring up the mud with its pectoral fins, thus obscures itself in a murky cloud beyond which appear

its long filaments, and, especially the first, with its glittering tip, offering an attractive bait to other fish. Thus stationed, this creature quietly expects its victim. On rove the shoals of fish, eager in quest of food. They pass one after another in succession, till at length one espies the bait. Forward the fish darts, either to examine or seize the expected prize ; but at that instant, aided by the broad, feet-like pectoral fins, the watchful angler springs up, and captures his prey. Such is the success of this voracious tyrant, that the fishermen examine its stomach, and sometimes obtain from it a considerable number of serviceable fish yet alive, which it had just swallowed. It is not, however, always that the angler thus obtains his food ; he is sometimes seen

floating on the surface, ready to snap at whatever prey comes within his sudden dart. Even the broad-winged loon is made his victim.

The immense voracity of the "angler" is one reason why he is sought by fishermen, who desire him not for the sake of himself but of the small fish which cram his stomach till it is puffed out of all due size. The angler-fish's fishing-line is a unique contrivance. It is one of several movable spines rising from the back of the head, arranged somewhat on the plan of a hook, and it can be swayed in any direction at the will of the



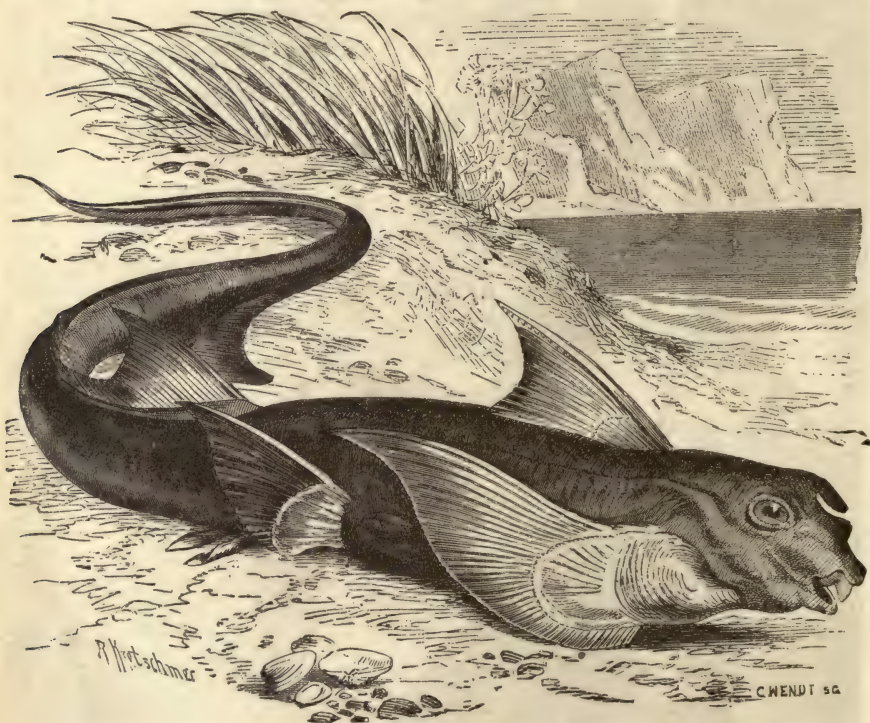
THE TAPE FISH.

fish. So, if it is tired and lazy, the fish does not need to go prowling and hunting for a meal, but takes it easy in the ambuscade of mud in which it hides, and waves the bait temptingly back and forth. The beautiful adaptation of nature in this bony apparatus to help the ugly fellow to a dinner without putting him to any trouble is a most curious fact. The angler-fish is only found north of the capes of the Delaware.

On the 23rd day of February, 1788, a fish more than thirty-three feet in length, a foot high, three inches broad, and four hundred pounds in weight which never had been seen before by the fishermen, was thrown

upon the coast of England. It was called the tape fish. Eight years later another fish of this kind was found by several women and since then several tape fishes have been thrown upon the shore, one of which was seventy-eight feet in length. This fish is said to be very beautiful, and its flesh is very savory.

Sea-cat is the common name of certain cartilaginous fishes which form a group intermediate between the sturgeons and the sharks. They are oviparous, the large eggs being enclosed in a leathery capsule. In



THE SEA-CAT.

the northern sea-cat the eyes have a greenish pupil, surrounded by a white iris, and shine, especially at night, like cats' eyes, whence the common name. The color is silvery, with brown spots; the tail is nearly as long as the body. It attains a length of three to four feet and is found in the North Sea and northern Atlantic, where it pursues the shoals of herring and other migratory fishes. The flesh is tough but the Norwegians use the eggs as food, and extract the oil from the liver for its wonderful healing properties.

The tribe of flat-fish comprehends the turbot, plaice, flounder and sole.

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These are generally confined to the muddy banks of the sea, where they can bury themselves as far as the head, for the purpose of escaping their enemies. They seldom rise far from the bottom. For the want of an air-bladder to buoy them up, which most of the other fishes possess, they are compelled to use their pectoral fins in a similar manner as birds use their wings to rise in the air, and this is not done without considerable exertion. They generally swim with their bodies in an oblique position and feed on such aquatic animals as come in their way. The halibut, the turbot and others grow to large size.

The eyes of the whole tribe are situated on one side of the head. While the under parts of their body are of a brilliant white, the upper parts are so colored and speckled as to render them almost imperceptible when they are half immersed in the sand or mud. Whenever they see any danger they sink into the mud and there stay motionless. Not being furnished with any weapons of defense, these fishes owe their security to this stratagem.

Rovers of the Sea.

The turbot is found on the northern parts of the English coast in greater abundance and of greater excellence, than in any other part of the world. It sometimes measures six feet in width and weighs over two hundred pounds. The left side is brown and covered with small tubercles, and the right side or lower surface smooth and white. The eyes are on the left side. It keeps on sandy grounds and is a great wanderer, usually in companies, living near the bottom, and feeding on small fish, crustaceans and mollusks. Though voracious, it is particular in its choice of food, and will bite at none but fresh bait. Its flesh is white, fat, flaky and delicate, and has been highly esteemed from remote antiquity. The American or spotted turbot, called also New York plaice, and watery flounder, is from twelve to eighteen inches long, and six to eight inches wide, sometimes attaining a weight of twenty pounds. It occurs along the coast of New England and the Middle States, and is a delicious article of food.

The common species of halibut grows to a length of from three to six feet, varying in weight from one hundred to five hundred pounds. It is found from the coast of New York to Greenland, and also on the northern shores of Europe. In summer it is caught by hook and line in shallow water, retiring to deeper in the winter. It is exceedingly voracious; its flesh is coarse and dry, but much esteemed by some persons when boiled and fried. The fins are considered a delicacy. In many parts of England the turbot and halibut are sold indiscriminately for each other. They are

however perfectly distinct. The eyes of the turbot are on the left, whilst those of the halibut are on the right of the head.

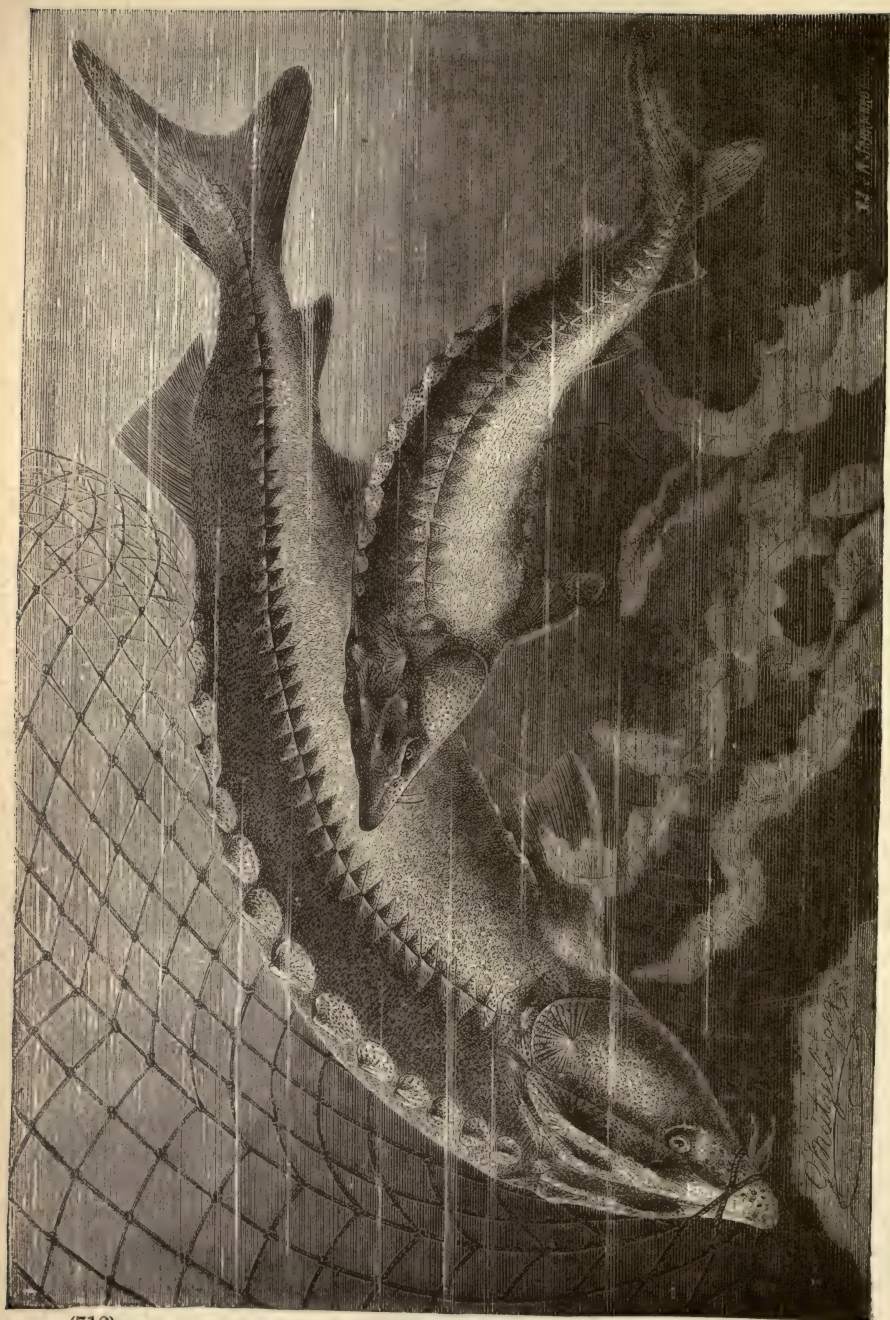
The common flounder of Massachusetts varies in length from ten to twenty-two inches, and in color from dull slate to rusty and blackish-brown; the scales are small and the surface is smooth. Flounders are very tenacious of life and may be transported considerable distances, and may be naturalized in brackish and even in fresh water. The distortion of the flounder family admirably adapts them for swimming on the bottom, where the situation of both eyes on the upper surface of the head allows an ex-



SPINY SEA-PORCUPINE.

tensive range of vision. The common sole has the body more elongated than in most flat-fishes, with a blunt and rounded muzzle. The length is from ten to twenty inches and the color runs from dark brown above and white below. It inhabits the sandy shores of Great Britain, and is one of the best and most delicious fishes for the table. The New York sole is six to eight inches long, dark brown, marked transversely with irregular black bands, and has small scales. It is found from Nantucket to North Carolina.

Sea-porcupine is a common name of fishes with comb-like gills and spines, with which the body is studded. In one genus the spines are

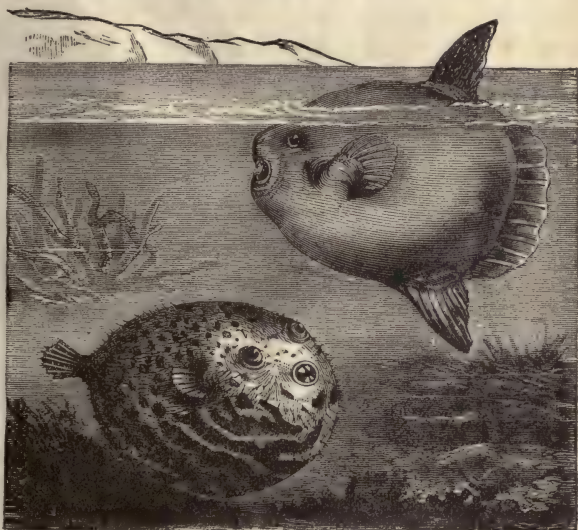


STURGEONS OF THE CASPIAN SEA.

long, thin, sharp with two root-like processes and capable of erection. There are nine species, of which three occur on the coasts of the United States under the name of balloon fish. They are not uncommon on the coasts of Massachusetts and New York, where they go by the names of puffer and swell fish, globe fish, urchin fish and spine belly.

Sturgeon is the name of cartilaginous fishes of the class of ganoids. They are generally large and inhabit the northern temperate seas of both coasts of America, eastern Europe and western Asia, from which they ascend the rivers in spring to spawn, returning to the salt water in autumn. Some species are also found in the great American fresh water lakes. Their food consists of any soft substances which they stir up from the bottom with their snout, and of small fish. They frequently jump out of the water.

The common sturgeon of Europe attains a length of six to ten feet and sometimes more. It is found in the Caspian and Black Seas, and the rivers opening into them, and sometimes on the coasts of Great Britain and the Baltic. The flesh is largely con-



GLOBE FISH AND SUN-FISH.

sumed in Russia, fresh, salted, and pickled. A large species also found in the seas and rivers of southeastern Europe is the beluga, attaining a length of twelve to fifteen feet and a weight of twelve hundred pounds, and occasionally much larger. It ascends the rivers opening into the Caspian and Black Seas with other and smaller species. Its flesh is tough, its air bladder furnishes a supply of isinglass, for which great numbers are caught in Russia. From the roe of the female, which sometimes constitutes one-third of the weight of the fish, caviare, a dish once considered a delicacy by some, is made. The skin is used for harness leather, and the dorsal cord, cut in pieces and dried, is used as food.

The sterlet, found in the Caspian sea, furnishes a most delicious food and the best caviare. In North America sturgeons are not found north of

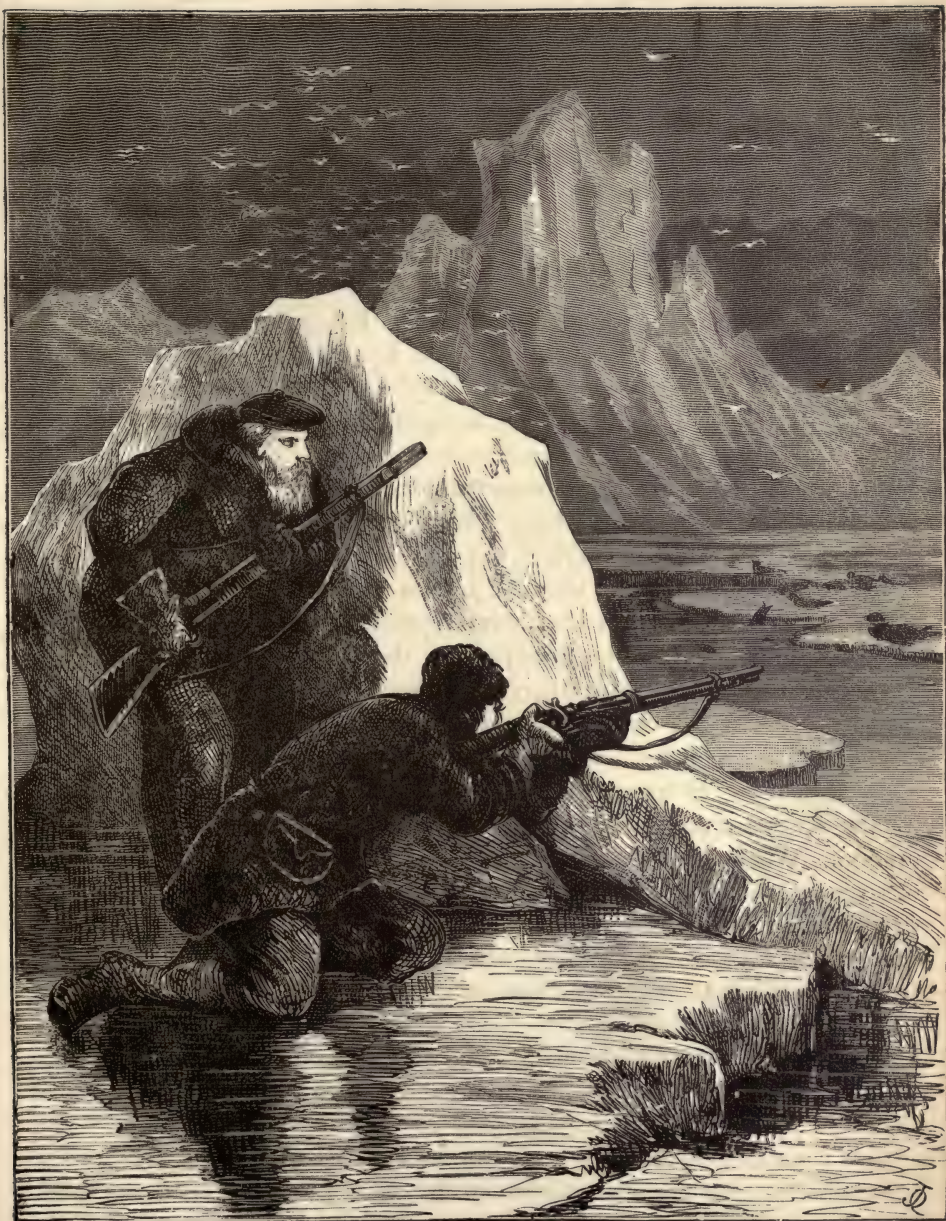
where the mean annual temperature is about thirty-three degrees. They seldom enter clear cold streams, but ascend muddy rivers in large numbers.

The sharp-nosed sturgeon attains a length of three to seven feet; it is found on the coasts of New England, New Brunswick and Nova Scotia, and is common in Long Island Sound from the middle of June to October. It is taken by harpoon and in nets. The short-nosed sturgeon attains a length of two to five feet, and is so common in the Hudson that its flesh in the market has been known as Albany beef.

In some rivers of Virginia sturgeons are found in such numbers that six hundred have been taken in two days with no more trouble than putting down a pole with a hook at the end to the bottom, and drawing it up again on feeling it rub against a fish. They are, however, chiefly caught in the night with harpoons, being attracted by the light of torches. The fecundity of this fish is exceedingly great.

The globe fishes are most remarkably constituted. They are covered merely with a multitude of sharp spines, differing in length and number in various species; their number, when they are small in size, compensating for their inferiority. Defended by a host of spears, to be levelled at pleasure, they are safe, for they severely wound the mouth of every fish that ventures to snap at them as prey, or the hand that attempts to capture them. But independently of these defensive arms, they are endowed with a power which renders them still less exposed to the attacks of their enemies. This power consists in distending themselves with air, so as to resemble balls of spines, and of floating on the surface of the water. Thus distended and floating, they are always upside down, and so carried along. When these fishes wish to rise to the surface, in order to avoid danger, they distend themselves to the full, which brings out all the spines in battle array, and so mount rapidly upwards. When they wish to descend again into the deep, they contract the sides of the body, compress the air, assume an elongated form, which is that of the body in reality, and thus gradually sink.

Two species of sun-fish are occasionally seen off our coasts, of which the short sun-fish is the most common. This fish is of circular form, and though there is a caudal fin, united to the dorsal fin and the under fin, there is no tail. The jaws are armed with an undivided cutting edge. This fish is very shining; it often grows to a great size, and has been taken weighing three hundred pounds, but such large specimens are very rare.



SHOOTING SEALS.



CHAPTER VII.

WANDERERS IN THE WORLD OF WATERS.

Hairy Creatures Roaming in the Deep—Immense Variety of Jelly-Fishes—The Shining Sea—"Myriads of Living Points"—Bathers Entangled in Hair—Portuguese Man-of-War—The "Jelly" Curiously Born—Hunger never Satisfied—The Trunk Fish—Mailed Rovers of the Sea—A Fish with Spurs—Famous Narwhal—Extraordinary Weapon—Finest Ivory in the World—Old Superstitious Notions—The Race of Sticklebacks—A Spiny Covering—Strong Defence against Foes—Sticklebacks in a Tub—Trying to Swallow an Eel—Fishes Building Nests—Desperate Fighters—Nest-Builders Discovered by Agassiz—Great Travellers—Unlimited Greediness—The Fan Fish—Native of Indian Waters—Lump Sucker—Strange-Looking Creature—The Sea-Snail—Sucker Fish—A Fish that Sticks—Towed Free by other Fishes—Riding Hundreds of Miles without Moving a Fin—Harness Fish—Toothless Swimmer—Delicious Eating—Hard Armor—Marvelous Turbot—Turbot Fishing—The Sly Silurus—Urchin Fish—Balloon of the Ocean—Air Out and Fish Under Water—Arrow Pike—A Dart in the Sea—Hearty Eater—Vast Size—Real "Old Salt"—Sharks and their Eggs.



QF the growth of the jelly-fish an interesting story may be told. A little oval body, covered with very fine hairs, swam about in the sea for some days, and then fixed itself by its smaller lower end. The opposite end now became depressed, the four corners became lengthened, and these were soon changed into tentacles, which so multiplied as to cover the upper end. Then transverse wrinkles might be observed on the body at regular distances, appearing first above and very slight, afterwards extending downwards, but all growing deeper and deeper, the edge of each one becoming serrated, or saw-like, so that the creature presents the appearance of a pine cone, surmounted by a tuft of tentacles. A separation is meanwhile going on, until the divisions resemble a pile of cups placed within each other. The upper ring is first detached, the others successively follow, and each one continues its development by itself, until it becomes a complete medusa, or jelly-fish. Thus what was at first a single individual becomes, by minute division, a number of entirely distinct animals. Moreover, the upper segment is not developed like the rest: it is intended merely to favor their growth by securing and preparing the substances they need; and its office appears to be performed as soon as the other segments begin to be dependent.

Of the jelly-fishes there is an immense variety :

Some in huge masses, some that you may bring
In the small compass of a lady's ring ;
Figured by hand divine, there's not a gem,
Wrought by man's art, to be compared with them,

They consist generally, when full grown, of a large, circular, gelatinous disk, *convex* above, and somewhat concave on the under surface, from which the feeding organs hang pendent. Strange to say, little fishes, alarmed by the sight of an enemy, rush under this mushroom or umbrella-like form, to remain until the danger is past, and then emerge again to sport and play about their sheltering friend. Fresh light is being continually thrown on the structure, varieties, and habits of the jelly-fish ; and the more we know of them, the greater is our astonishment and admiration.

Astounding, indeed, is the story of a medusa's growth ; yet, if possible, still more so is the fact that this creature has eyes, each of which is a gelatinous spherule of a deep red tint, protected on each side by two pairs of long, pendant lobes. When crushed beneath the compressorium, it discharged a multitude of prisms of highly refractile substance, set close together.

Unrivalled Brilliancy of the Ocean.

Night often presents to the voyager a phosphorescent scene of unrivalled splendor and beauty. It is as if the sea were an immense plane of glass studded with diamonds of the first magnitude ; or as if the luminous points with which its whole surface is literally bestrewed were sparks of fire. If they are regarded, as they have been, as efflorescences of flame, they pass the sides of the vessel every moment, and form in her wake a train of brilliancy such as no comet "e'er drew o'er half the heavens." Sir Walter Scott thus pictures it in vivid words :—

Awaked before the rushing prow,
The mimic fires of ocean glow,
Those lightnings of the wave ;
Wild sparkles crest the broken tides,
And flashing round, the vessel's sides
With elfish lustre lave ;
While far behind, their livid light
To the dark billows of the night
A gloomy splendor gave.

Poppig in his "Voyage to Chili," says: From the top-mast the sea appeared, as far as the eye could reach, of a dark red color, and this in a streak the breadth of which was estimated at six miles. As we sailed slowly along, we found that the color changed into a brilliant purple, so

that even the foam which is seen at the stern of a ship under sail, was of a rose color. The sight was very striking, because this purple streak was marked by a very distinct line from the blue waters of the sea, a circumstance which we the more easily observed, because our course lay directly through the midst of this streak, which extended from south-east to north-west. The water taken up in a basket appeared, indeed, quite transparent; but a faint purple tinge was perceptible when a few drops were placed upon a piece of white china, and moved rapidly backwards and forwards in the sunshine.

Infinite Numbers of Animalcules.

A moderate magnifying glass showed these little red dots, which only with great attention could be discovered with the naked eye, to consist of animalcules, which were of a spherical form, entirely destitute of all external organs of motion. We sailed for four hours, at a mean rate of six miles an hour, through this streak, which was seven miles broad, before we reached the end of it; and its superficies must, therefore, have been about a hundred and sixty-eight square miles. If we add that these animals may have been equally distributed in the upper stratum of water to the depth of six feet, we must confess that their numbers infinitely surpassed the conception of the human understanding.

Hence Crabbe says to the sea-side visitor—

While thus, with pleasing wonder, you inspect
Treasures the vulgar in their scorn reject,
See as they float along the entangled weeds,
Slowly approach, upborne by bladdery reeds;
Wait till they land, and you shall then behold
The fiery sparks those tangled fronds enfold;
Myriads of living points : the unaided eye
Can but the fire, and not the form, descry.

Spallanzani affirms that this phosphorescence is owing, in the medusæ, to a glutinous substance issuing from certain parts of the body. Expressed into different liquids, as into salt water, but especially into fresh water, warm, or milk, it gives to them a phosphoric light. A single jelly-fish, he says, thus expressed into twenty-seven ounces of cow's milk, rendered it so resplendent that we might have read the character of a letter by it at the distance of three feet. The dead medusa possessed for a considerable time its phosphorescence, and it was renewed by pouring water upon it, even some time after it had ceased to shine.

Two jelly-fishes, out of an immense variety, are, according to Forbes, the only true nettles of our seas. One of these—the hairy cyanea—has a dingy, dark-brown disk, about a foot across, and it drags after a great

number of filaments, like coarse hair. Woe to the bather who comes into contact with one, for to get out of its entangling meshes seems impossible, until the creature, finding its course impeded, uncoils its hair, and leaves him to himself. We have known more than one instance of great suffering from such an accident. There appears a considerable redness in the parts which have been touched, and swellings of the same color. Dicquemare says: After the end of some days, when the pain is gone by, the heat of the bed will cause the blisters of the skin to re-appear.

Sudden Collapse.

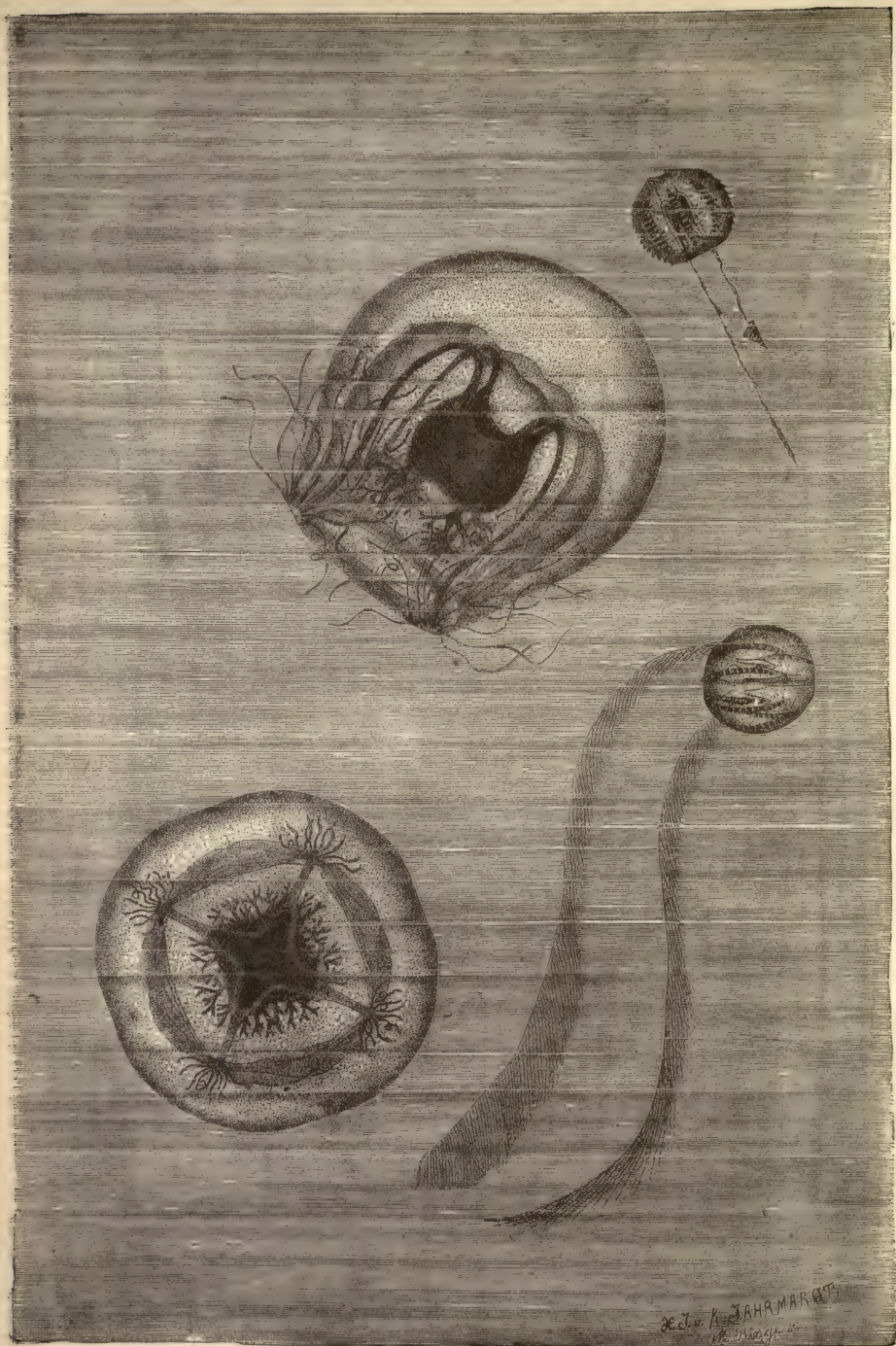
Another singular fact should not be omitted. If a common jelly-fish be taken from the sea or the shore in some vessel and carried home, and if it be looked for a few hours after, it will be gone. All that remains will be water, not distinguishable by the chemist from sea-water, except a small piece of membrane: yet these, with life, formed a medusa—a creature with many powers.

Jelly-fishes would hardly be seen in the water, were it not for their beautiful colors. The common varieties move by the alternate contractions and dilations of the gelatinous disk; others, like the Portuguese man-of-war, have a large vesicle, which supports the whole community at the surface of the ocean, motion being effected by the contractile tentacles and the contraction of the air bladder.

This class presents the curious phenomena of alternate generations. The "tubularia," common in pools left by the tide, hangs like a flower from a slender tube, with the mouth surrounded by tentacles, each animal connected with the rest of the community and each mouth receiving nutriment for the whole. The young of this hydroid do not resemble the parent, but are little, delicate, translucent jelly-fishes, like little cups, from which hang down long threads and a proboscis at the end, which is the mouth. By the side of the buds branching out from the parent hang bunches of little spheres, from which the jelly-fishes are produced. Along the proboscis of the floating cups are other spheres of eggs from which are produced little pear-shaped bodies, which grow into the first mentioned branching hydroid. The grandparent therefore resembles the grandchild and the hydroid is reproduced through a generation of jelly-fishes.

A Hungry Race of Creatures.

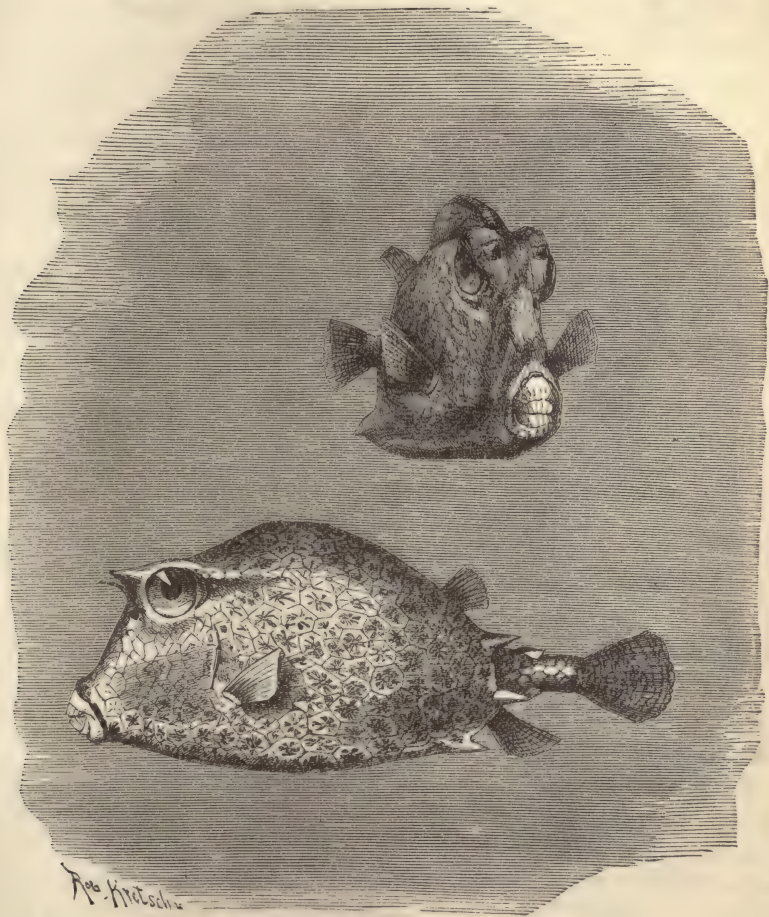
Some very handsome jelly-fishes do not originate from any hydroid, but reproduce themselves by eggs. They are very voracious, feeding upon minute crustaceans, almost any small marine creatures, decaying animal or vegetable matter, and even their own species.



SCOTT & JAHNKE
NEW YORK

SWIMMING JELLY-FISHES.

The Portugese man-of-war is very poisonous to the touch. In picking up specimens stranded on the shore of Key West, Fla., the hands of fishermen have been severely stung by them, the burning, smarting pain lasting for hours. It may be compared to a colony of hydractinia, in which there are nutritive and reproductive zooids and medusa buds.



REMARKABLE TRUNK-FISH.

Some of these jelly-fishes are very small, not larger than the head of a pin.

The trunk or coffer-fish belongs to the class of mailed fishes; most of its body being covered with a hard shell, made up of hexagonal plates firmly united together along the edges. These plates are generally quite rough and so arranged as to present a very ornamental appearance.

The mouth of the fish is small with prominent teeth, and the dorsal and ventral fins are situated far back near the tail, where the covering of the body is soft, so that the fins, including the caudal extremity can be used in propelling the body through the water.

In some species there are a number of sharp spurs on different parts of the body. This fish is found mostly in tropical waters, where it often grows to a length of a foot or more. Specimens are also taken now and then along the shores farther north. It is of no practical value as a food-fish and very little is known about its habits, or the animals upon which it feeds. It is very clumsy and can easily be caught by the hand.

Formerly the strong and imperishable shell, or armors of the trunk-fish were collected and brought to Europe as a curiosity. The trunk-fish is believed to be poisonous; the stomach is membranous and very large; the liver is also large, often yielding a considerable quantity of oil. Yale's trunk-fish, found on the coast of Massachusetts and New York, has two abdominal spines.

The Narwhal.

A well-known denizen of the northern seas, the sea-unicorn, better known as the narwhal, from the Gothic, signifying "beaked whale," is no less interesting. The head of the narwhal is round and convex in front, the lower jaw being without teeth, while from the upper jaw springs the curious weapon which gives this animal its world-wide reputation. It is only in the male that this strange beak is developed, it being merely the development of the left tusk, which increases rapidly till it becomes a long, spiral, tapering rod of ivory, sometimes attaining the length of ten feet. Speculation as to the purpose of the narwhal's horn has been baffled, though that it is employed in some definite task is evident from the fact that the tip is always smooth and polished, however rough and encrusted it may be toward the base. It is probable that it is a weapon of attack, for narwhals have been often seen to joust and playfully charge each other, fencing with their long ivory lances as they churn up the sea in swift charges. So it is probable that the narwhal horn is analogous to the tusk of the boar or horn of the deer.

The ivory of the narwhal's horn is remarkably hard, solid, close in fiber; perhaps a better article than the tusk of the walrus or the elephant. It has, therefore, a very considerable commercial value. In former times the entire tusk was believed to be of incalculable value. Supposed to be obtained from that fabled animal, the unicorn, it had, it was imagined, magical qualities, among which was that of transforming the deadliest poisons into harmless potions.

This antidotal quality was necessary to the unicorn, which was supposed to live in deserts among loathsome beasts and poisonous reptiles. When the unicorn went to the springs and pools which had been poisoned by the contact of other venomous mouths, the simple dipping of his horn in the water made it pure again. Thus, in those days when kings suspected poison in every wine chalice, the possession of this supposed unicorn's horn eased their royal minds not a little.

The narwhal is held in great esteem in Greenland, for, independent of its value, it is a harbinger of the coming of the whale. The ivory of the



THE NARWHAL OR SEA-UNICORN.

tusk is put to a great variety of uses, and many a narwhal perishes by means of the tooth which has been extracted from some near kinsman. It is easily slain, as it possesses no great power of diving. It seldom descends over two hundred fathoms below the surface, and when it rises the animal is so tired as to be easily killed by a spear thrust. Whaling ships are always on the outlook for narwhals, on account of both the oil and the ivory, and lances are used to capture the playful animals, which seem to have but little fear, and gather around the fatal boats with great curiosity. As they congregate in large herds, a very large catch is often a matter of only a few hours.

Their tusk is a long, hard, spiral and sharp pointed weapon which projects from the anterior part of the upper jaw. When urged with all their force it will penetrate even into the solid timbers of a ship and the body of no animal is sufficiently hard to resist its effects. The detached weapons of the narwhal are deposited in many cabinets as the horns of the fabulous quadruped the unicorn. The females produce each a single young one at birth and this they nourish for several months with milk.

The Sticklebacks.

Several species of stickleback are found in fresh water ponds and streams, and one species exists in the salt water. They are very active and voracious, and live on aquatic insects and worms. They are included, under a great diversity of names, in the Natural History of every European country. They should even exist as far as Greenland, if it be true indeed that Fabricius saw there the same species, and not some one of those of America.

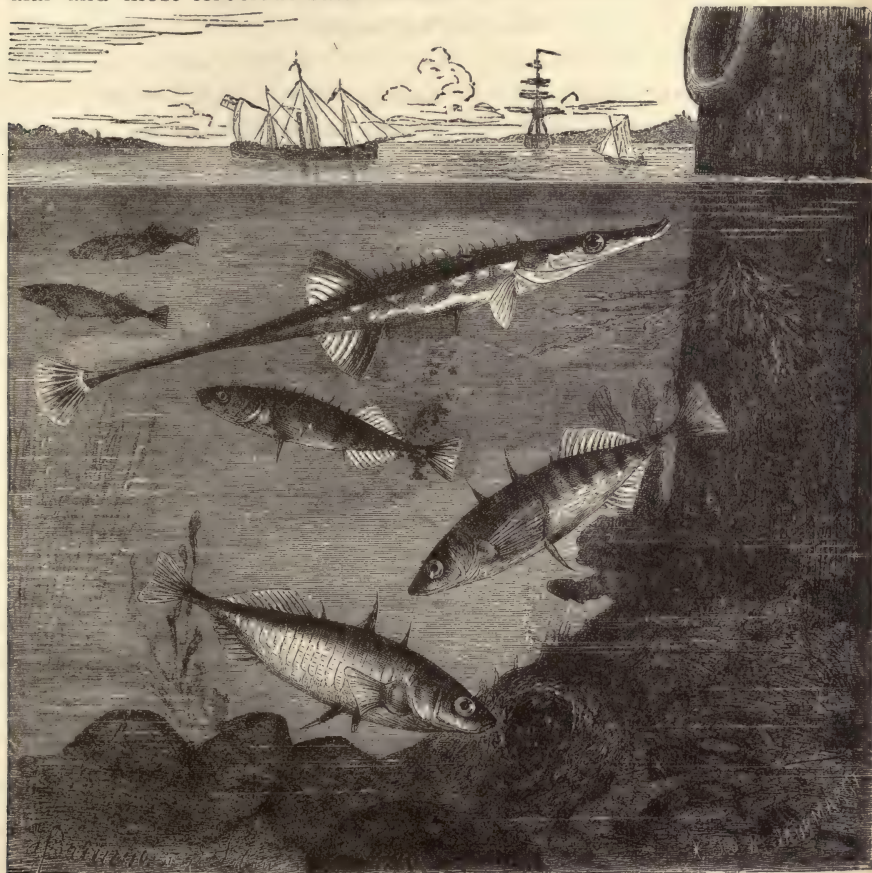
Their extreme multiplication is surprising, for the eggs of the sticklebacks are large, and they cannot lay many of them. It is true, on the one hand, that they have but little to dread from other fishes, as they are defended against them by short and sharp spines; but they have internal and external enemies by which they are unceasingly tormented. Thus, one species attaches itself to the skin, and sucks their blood, while another sometimes almost fills the entire abdomen, compressing their intestines, and reducing them to a very small space.

Bloch assures us that these fishes live but three years. They are extremely agile, lively in their movements, and of an active disposition. Backer states that they leap vertically out of the water, to more than the height of a foot, and that in an oblique direction they can make springs still more considerable, when they are obliged to pass over stones or other obstacles. They can subsist a tolerably long time out of the water, especially when they fall into the humid grass. Their voracity is excessive. Backer has seen a stickleback devour, in the course of five hours, seventy-four new-born fish, of one species.

The Three-Spined Stickleback.

The stickleback with three spines is the most common species, and is distinguished by the body being protected at the sides with shield-like plates, and the possession of three spines on the back. It is of an olive-color above, and silvery white beneath, and varies from two to three inches in length. In the breeding season, the male assumes a pink hue on the under parts of the body, and the general color of the upper parts is brighter, and often green.

A naturalist thus describes the habits of these fishes, during their confinement in a tub:—When a few are first turned in, they swim about in a shoal, apparently exploring their new habitation. Suddenly one will take possession of a particular corner of the tub, or, as it will sometimes happen, of the bottom, and will instantly commence an attack on his companions; and if any one of them ventures to oppose his sway, a regular and most ferocious battle ensues.



SPINY STICKLEBACKS AND NEST.

I once saw a very lively stickleback engaged in taking its prey from a clump of sea-weed, in doing which it assumed every posture between the horizontal and perpendicular, with the head downward or upward, thrusting its projecting snout into the crevices of the stones, and seizing its prey with a spring.

Having taken this fish with a net, and transferred it to a vessel of water, in company with an eel of three inches in length, it was not long

before the latter was attacked and devoured head foremost—not, indeed, altogether, for the eel was too large a morsel, so that the tail remained hanging out of the mouth; and it was obliged at last to disgorge the eel partly digested. It also seized from the surface a moth that fell on the water, but threw up the wings. The effect of the passions on the color of the skin in the species of this genus is remarkable; and the specimen now spoken of, under the influence of terror, from a dark olive with golden sides, changed to pale for eighteen hours, when it as suddenly regained its former tints. It spawns in spring, and the young, not half an inch in length, are seen along the sea-margin in summer.

A Fish that Makes a Nest under Water.

Nearly thirty years ago, the following remarks were made by an intelligent observer, unacquainted with Natural History as a science, and who was not aware of what was then closely studied by others on a kindred species: In a large dock for shipping on the river Thames, thousands of pricklefish were bred some years ago, and I have often amused myself for hours by observing them. While multitudes have been enjoying themselves near the shore in the warm sunshine, others have been busily engaged in making their nests—if a nest it may be called. It consisted of the very minutest pieces of straw or sticks, the exact color of the ground at the bottom of the water, on which it was laid, so that it was next to an impossibility for persons to discover the nest, unless they saw the fish at work, or observed the eggs.

The nest has a top or cover, with a hole in the centre, in which are deposited the eggs or spawn. This opening is frequently concealed by drawing small fragments over it; but this is not always the case. Many times have I taken up the nest, and thrown the eggs to the multitude around, which they instantly devoured with the greatest voracity. These eggs are about the size of poppy-seeds, and of a bright yellow color; but I have seen them almost black, which I suppose is an indication that they are approaching to life. In making the nest I observed that they used an unusual degree of force when conveying the material to its destination. When the fish was about an inch from the nest, it suddenly darted at the spot, and left the tiny fragment in its place, after which it would be engaged for half a minute in adjusting it. The nest, when taken up, did not separate, but hung together like a piece of wool.

After this statement was made, Costa gave great attention to the habits of the stickleback. He watched the whole process of the construction of the nest, the laying of the eggs by the female, and the care taken of them by the male. He says: The stickleback has the foresight to cover

the nest heavily with sand, to prevent its being swept away by the waters; and they glue together the materials of which the nest itself is composed, by means of the mucous excretion which exudes from their bodies. To make sure that all parts of the nest are united with sufficient solidity, the fish suspends himself in the water immediately above it, with his head downwards, and makes rapid vibrations with his pectoral fins and his tail. By this means, any parts of his dwelling which are not properly constructed at once become loose and detached, and he instantly darts down and repairs the defect.

During an entire month, he is the sole guardian of the eggs which the females lay within, and he has to defend them, not only against the attacks of other fishes, but against the ferocious and unnatural appetites of the parents themselves. He removes the stones which accumulate at the mouth of the nest, he enlarges the opening, and by the singular vibrations of his tail and fins, he changes and purifies the water in the neighborhood, and in short he never relaxes his care of the young until they are fully able to provide for themselves.

Nest-Building Hassars.

There are two fishes in Demarara, the flat-headed hassar, and the round-headed hassar, which make nests like the sticklebacks. Sir Richard Schomburgh, when recounting his "Travels in British Guiana," states that not only does the hassar form a perfect nest for its spawn of all kinds of fibres from among the aquatic plants, but it watches, with the most active maternal care, till the young brood escape. The nest, like that of the magpie, is a real work of art. In April the hassar begins forming the nest, until it resembles a hollow globe flattened at the poles, the upper one of which reaches the surface of the water. An orifice, adapted to the size of the mother, opens into the interior. The negroes frequently capture the hassars, by putting their hands in the water, close to the nest; when the guardian parent, rushing to a repulse of the invader, is dextrously seized and thrown on the land.

These two fishes, so much alike in their habits, exhibit a remarkable difference in the material of their nests; the flat-headed hassar using leaves, and the round-headed forming its fabric of grass. At certain seasons they burrow in the bank, and it is only in the rainy season that they make their nests and lay their eggs. Often have I been surprised, says Hancock, to observe the sudden appearance of numerous nests in a morning after rain occurs, the spot being indicated by a bunch of froth which appears on the surface of the water over the nest. Below this the eggs are placed on a bunch of fallen leaves or of grass (the round head

of grass, the flat head of leaves) which they cut and collect together. By what means this is effected seems rather mysterious, as they are destitute of teeth. It may possibly be by the use of their serrated arms, which form the first ray of the pectoral fins.

Agassiz alludes to a nest-building fish, which he observed in Lake Sebago, in the State of Maine; and others have been observed in Australia. Thus, Mitchell says, in his work on "Tropical Australia:" In a dry part of the river (Maroon), I met with many instances of the singular habit of the eel-fish or jew-fish. I had previously observed elsewhere, in the aquatic reeds growing in extensive reaches, clear circular openings, showing white parts of the bottom, over which one or two fishes continually swam round in circles. I now found on the dry bed that such circles consisted of a raised edge of sand, and were fitted with stones, some as large as a man's closed fist. Suranigh, a native, told me that this was a nest of a pair of these fish, and that they carried the stones there and made it. The general bed of the river, where we saw these nests, consisted wholly of deep, firm sand, and that the fish had some way of carrying the stones to such spots seemed evident.

Fishes that are Great Travellers.

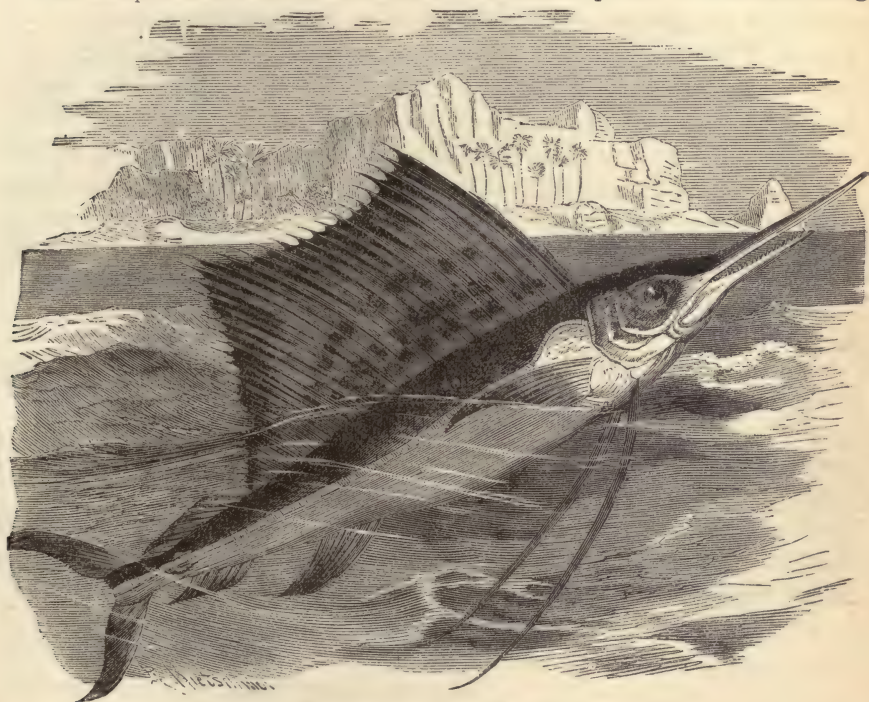
Nearly all the species of sticklebacks or mackerel are gregarious, and unite in immense shoals. Some of them are migratory, making long voyages at certain seasons of the year. It is believed that they are all eatable. From the elegance of its shape, and the brilliancy of its colors, the mackerel, when alive, is one of the most beautiful fish that frequents our waters. The mackerel season is a very busy and profitable one on the British coast. They are taken in great quantities by drift-nets reaching about twenty feet below the surface, and extending for more than a mile.

The mackerel will bite at almost any bait, especially anything resembling a living prey. Their voracity has scarcely any bounds, and when they get among a shoal of herrings they make such havoc as frequently to drive it away. After they are taken out of the water they exhibit a phosphoric light. The sticklebacks receive their name from the prominent isolated spines, which are found along the back in front of the dorsal fin. They are generally very active, and are confined to the temperate and arctic zones of the northern hemisphere. There are a number of species, which, besides the spines along the back have spines in connection with some of the other fins, and the sides are generally ornamented with quite large and thick scales, so that the sticklebacks are well protected against most other carnivorous fishes. The fresh water species generally have nests with openings in the sides, and the nests are guarded by the

males. The fifteen-spined stickleback forms its nests among the sea-weeds, and binds its eggs firmly together until they are hatched, the males guarding them meanwhile, the same as do the males of the fresh water species.

While the common sword-fish is found in the Mediterranean and on both sides of the Atlantic Ocean, the fan-fish is an inhabitant of the seas of the torrid zone, especially the Indian Ocean. It is said to keep itself near the surface of the water so that its large dorsal fin protrudes. Its mode of living is similar to that of the common sword-fish.

The lump-sucker is a common and remarkable species of fish inhabiting

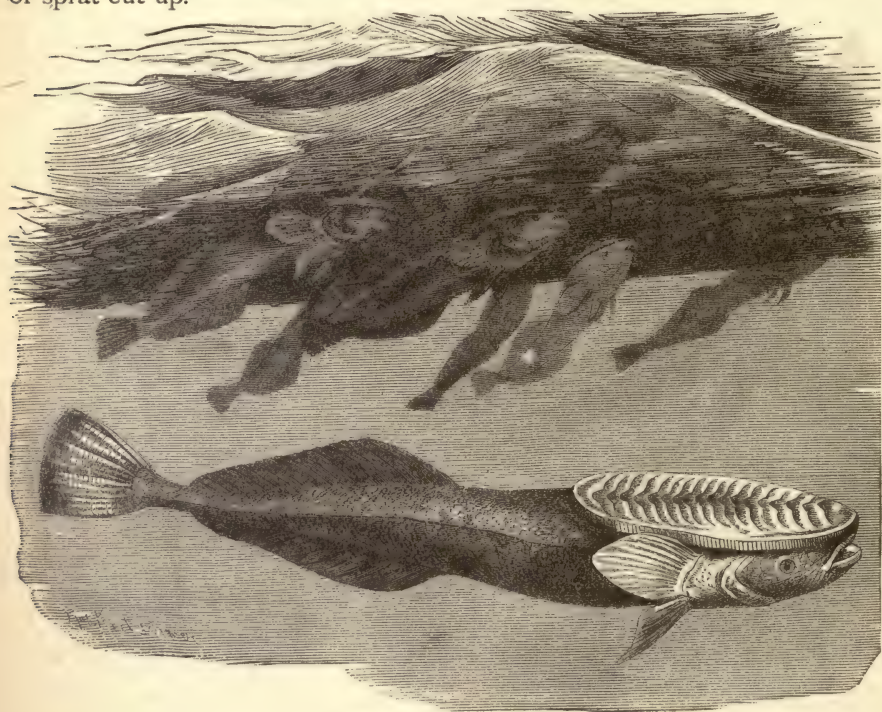


SWORD OR FAN-FISH.

the British seas, and belongs to a family popularly known as sucking fishes. This one is a large-bodied, small-finned fish, bearing on its back an elevated crest or ridge, and having a powerful sucker under its throat, formed of the combined pectorals and ventrals. Before the spawning season it is of a brilliant crimson color, mingled with orange, purple, and blue, but afterwards changes to a dull blue or lead color.

When full-grown it is rough with tubercles, but when very young is smooth and beautiful, and marked with brilliant stripes of various hues. In the seas of the Orkneys, in June, numbers of the young fish, half an

inch in length, are seen swimming around floating sea-weeds. In the old fish the sucker is so powerful that a pail of water, containing some gallons, has been lifted up by a person holding the tail of a lump fish adhering to the bottom. It ranges from the shores of Greenland to those of the south of England, and westward as far as the coast of North America. The eyes are large, and, it has been said, "made it look like a cat or owl," whence one of its common appellations is the "sea-owl." It is taken with lines and hooks; the baits are sand-worms, shell-fish, herring or sprat cut up.



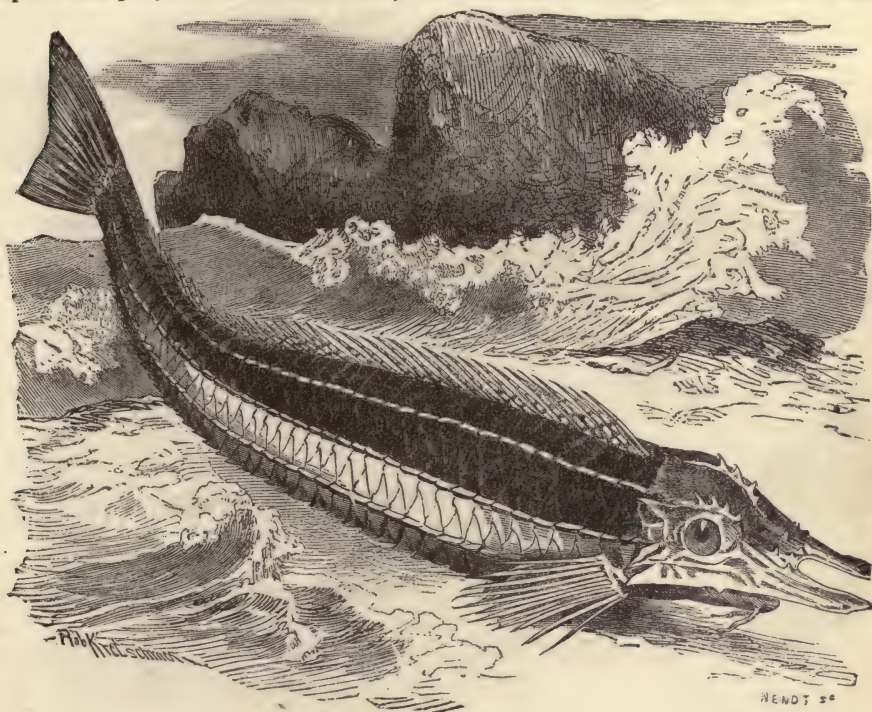
THE SUCKER FISH.

This strange-looking fish may often be seen exposed to view in the shops of the London fishmongers. Its flesh, and particularly that of the male, is regarded as excellent. It is chiefly in April and May that the lump-sucker is taken, as it then approaches the shore for the purpose of breeding.

Another genus of this family consists of a number of small fishes which have two disks on the under surface of their bodies, one formed by the pectoral and the other by the ventral fins. They thus adhere to stones, rocks, and shells. They have wedge-shaped, defenceless bodies, smooth and without scales, often painted with the most defined and

brilliant colors. The sea-snail is a third genus of this family. They are found under stones at low-water mark, and are not so brilliantly colored as others of the tribe. They are furnished with a single sucker formed by the pectorals and ventrals.

The popular name of the remora is "spiny-rayed fish." Above the head and anterior dorsal vertebræ is an oval disk, presenting from the middle to both sides oblique plates, arranged like the slats of a venetian blind, and covering the surface of the disk. On the middle of the under surface are spine-like projections, connected by short bands with the skull and vertebræ,



HARNESS FISH.

and their upper margin is beset with fine teeth. By means of this apparatus these fishes attach themselves to rocks, ships, or bodies of other fishes, especially sharks, which transport them to places where food is abundant and often from the tropics to the temperate regions. None of the species feed upon the fish to which they are attached, their food being small fishes and floating animals. The ancients believed, that this small fish had the power of arresting the progress of a ship by adhering to the bottom.

The harness fish exhibits a great number of bony scales or shields, two strong bones protrude from the upper jaw and the mouth is toothless. It

is found in the Mediterranean and in parts of the South Atlantic Sea and only approaches the coast for the purpose of spawning. It is said, to live alone and to be able to swim with great velocity. It feeds on medusæ and mollusks and is said to be highly esteemed for its fine and delicious flesh. For the purpose of taking off the armor of this fish before preparing it for the table, it is necessary to scald it, because this armor is impenetrable to the knife.

The Sluggish Turbot.

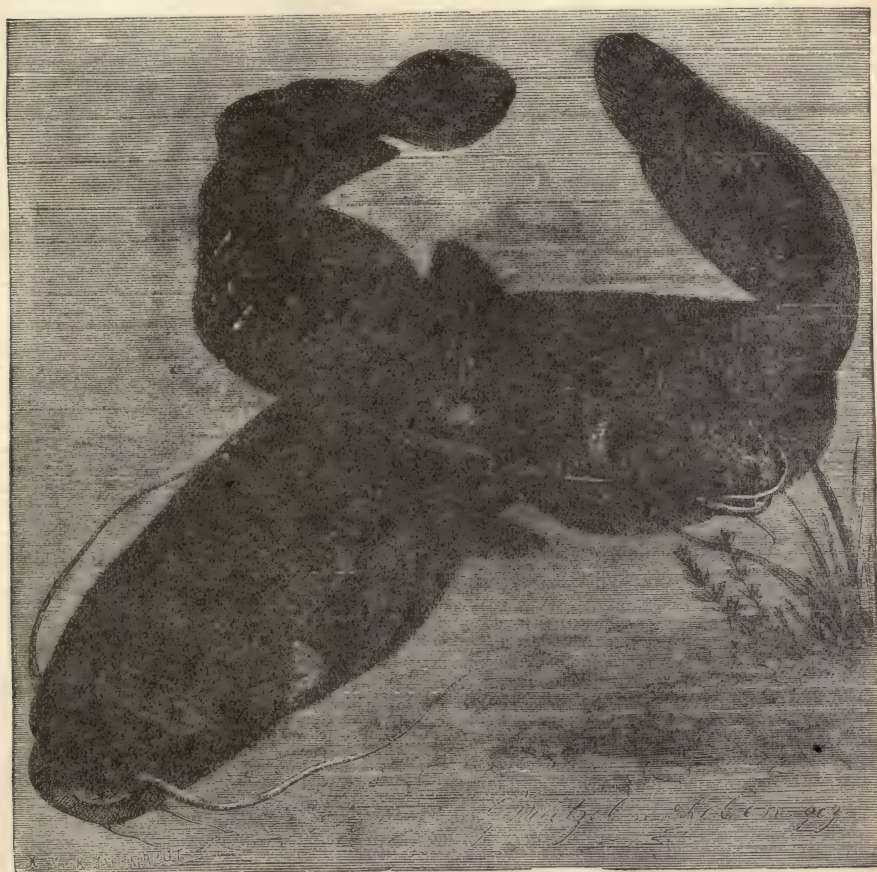
The turbot is of a short and broad form, and rather deeper than many of the flat fishes. Its prevailing color is brown, and the whole of the colored side is studded with hard and roundish tubercles. It is called in Scotland the rawn fleuk, and the rannack fleuk. As the turbot does not possess the power of rapid motion, it would be liable to speedy extermination by its numerous enemies, were it not so formed and endowed as to render it quick in perceiving danger; while it is also guarded by its habits, which occasion it constantly to be near the bottom, and also by its color, for while one half of the fish is nearly white, the other half approaches to the muddy color of that part of the element in which this fish resides. The position of the eyes is also singularly adapted for securing its safety. They are not placed on each side of the head, but only on that side which is uppermost when it is in motion.

The turbot is most active in the night-time, when, perhaps, its enemies are less vigilant; and in the day-time it lies at the bottom, with its dark side uppermost, and is consequently difficult to be distinguished. It is said that, when apprehensive of danger, it will remain perfectly still. Man is, probably, its most active enemy. Great care is necessary in having a suitable bait; for, though voracious, the turbot is delicate in its choice of food. A piece of herring or haddock is commonly used for a bait, but if it has been twelve hours out of the water, though not tainted, the turbot will not take it. Many years ago, and it may still be the case, the Dutch purchased of the Thames fishermen the lesser lamprey, for bait, to the value of several thousand dollars a year. The Scarborough fishermen were accustomed to obtain a supply by land carriage from the river Wharf, a distance of about sixty miles.

The fishery is carried forward to the north-eastern coast. Each person is provided with three lines, which are coiled upon a flat, oblong piece of wicker-work; the hooks being baited, and placed very regularly in the centre of the coil. Each line is furnished with fourteen score of hooks, at the distance of six feet two inches from each other. The hooks

are fastened to the lines upon "steads" of twisted horse-hair, twenty-seven inches in length.

When fishing, there are always three men in each boat, and consequently, nine of these lines are fastened together and used as one line, extending nearly three miles, and furnished with two thousand five hundred and twenty hooks. An anchor and a buoy are fixed at the first end



OLD AND YOUNG SILURUS.

of the line, and one more of each at the end of each man's line; in all, four anchors, which are commonly perforated stones, and four buoys, made of leather or cork. The line is always laid across the current, and remains on the ground about six hours, as it can only be shot or hauled at the turn of the tide. The rapidity of the tide on this coast prevents the use of hand-lines, and therefore two of the men, commonly wrap

themselves in a sail and sleep, while the other keeps a sharp lookout, to observe the weather, and from fear of being run down by ships.

The boat is about one ton in burden, rather more than twenty feet long, extreme breadth five feet, and it is rowed with three pairs of oars. A larger description of boat is also used in the Scarborough turbot fishery. It is forty feet long, fifteen broad, and of twenty-five tons burden, and is called the "five men boat," though usually navigated by six men and a boy; but one of the men is hired to cook, and does not share in the profits with the other five. When they reach the fishing-ground they anchor, and proceed to fish, and being provided with a double set of lines, they haul one and shoot another every turn of the tide. They generally run into harbor twice a week to deliver their fish. Similar means are employed along the southern coasts, but the London market is chiefly supplied by the Dutch fishermen.

The fishing season commences in March, and terminates in August. The Dutch are supposed to have drawn not less than half a million dollars a year, for the supply of this fish to the London market alone. The English fishermen purchase at sea largely of the Dutch; nevertheless, the Dutch send boats laden with turbot up the Thames, each boat bringing about one hundred and fifty fish. The Danes also are said to derive a large income for sauce to this luxury of the table, extracted from a million of lobsters taken on the rocky shores of Norway. The finest turbot are taken on the Flemish banks, and the banks called Broad Forties. Excellent fish are also taken by the French fishermen, on the two large sand-banks called the Varne and the Ridge, stretching towards the French coast in the Channel, not many miles from Dover. These they sell to the English out at sea, or send into Dover.

The average size of turbot is from three to ten pounds weight; but some of huge size have been occasionally taken, which have weighed from fifty to seventy pounds; and one was caught near Whitby, which weighed one hundred and ninety pounds.

The Sly *Silurus*.

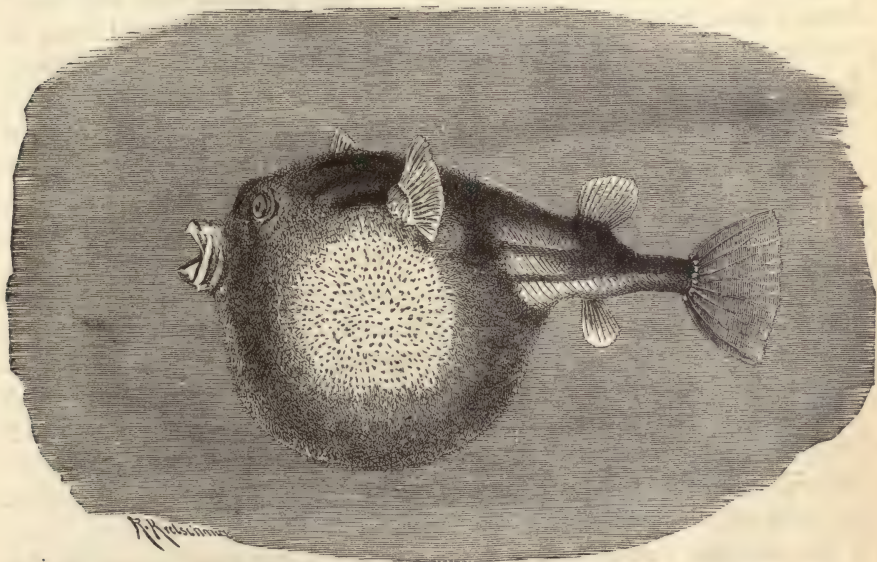
The sheat fish, as it is sometimes called, a member of another family, is found not only in almost all the fresh waters of Europe, but even in those of Africa and Asia. Pliny described it as existing in the Nile. Bloch mentions that specimens weighing from seventy to eighty pounds have been taken in canals near Berlin.

The two very elongated barbules of the upper lip are supported by extensions of the intermaxillary bones, which increase the sphere of action and consequent utility of these organs of touch, by extending

their influence beyond the range of the shorter parts of the lower lip. Thus it is shown to be a ground-feeder ; and Bloch states that it seldom leaves its hole except during storms.

Another family have the head furnished with a rough, flat buckler, and broader than in any other silurus, because the frontals and parietals give out lateral plates, which cover the orbit and the temple. They come from the Nile, the Senegal, and from some rivers of Asia. Their flesh is not good.

The singular urchin fish inhabits the Mediterranean and sometimes ascends the Nile. In deep water they swim like other fishes, but when irritated they come to the surface and take in some air, which blows them



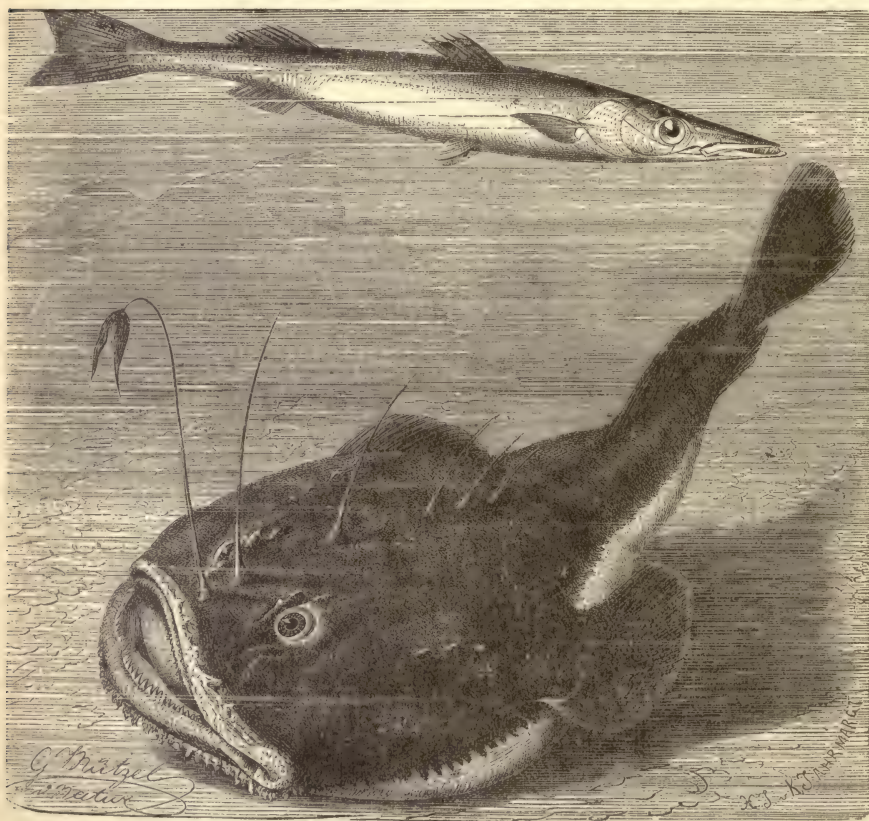
FAHAK OR URCHIN FISH.

up, so that their wrinkly, lax abdomen, which is capable of considerable extension, becomes smooth and then looks like a ball from which numerous small spines protrude. Whilst in this state, they are unable to swim, and would fall a prey to other fishes, if they were not protected by their spines. As soon as the danger is over, the fish allows the air to escape and is then enabled to again use its fins. The Fahak is tenacious of life and is able to be out of water for a long period of time. Its flesh is eaten by the poorest Tellahs, but its roe is considered poisonous.

The pike has various names in our language, as pickerel, luce or lucie, and, in Scotland, gedd. Pike of small size are often called jack. The

habit of the pike is to remain under the shelter of water-plants, until his attention is attracted by some passing victim, when, like the tiger springing from the jungle, he rushes forth, seldom, indeed, missing his aim. The jaws and palate of the pike are most formidably armed with sharp teeth, of various sizes.

Of the daring and ferocity of this fish many authenticated instances are on record. Walton says: "Gesner relates, that a man going to a



ANGLER AND ARROW PIKE.

pond (where it seems a pike had devoured all the fish) to water his mule, had a pike bite his mule by the lips, to which the pike hung so fast that the mule drew him out of the water, and by that accident the mule angled out the pike." And the same Gesner observes, "that a maid in Poland had a pike bite her by the foot, as she was washing clothes in a pond. But I have been assured by a friend who keeps tame otters, that he hath known a pike, in extreme hunger, fight with one of his

otters for a carp that the otter had caught, and was then bringing out of the water." At Trentham, Staffordshire, a pike seized the head of a swan, as she was feeding under water, and gorged so much of it that both fish and swan perished; the keepers perceiving the swan fixed with its head under water for an unusual time, took a boat to go to the bird's assistance, but it was too late. Yarrell says, "The head keeper of Richmond Park was once washing his hand over the side of a boat, in the great pond in that park, when a pike made a dart at it, and he had but just time to withdraw it."

A gentleman in Weybridge, walking one day by the side of the river Wey, near that town, saw a large pike in a shallow creek. He immediately pulled off his coat, tucked up his shirt sleeves, and went into the water to interrupt the return of the fish into the river, and to endeavor to throw it out on the bank by getting his hands under it. During the attempt, the pike, finding he could not make his escape, seized one of the arms of the gentleman, and lacerated it so much that the marks of the wound were visible for a long time. The following anecdote is taken from one of the public papers, August 25, 1846:—"On Thursday, Mr. Collet, in company with a friend from London, was fishing at Shepperton, for barbel, when the bait was taken by a roach, which, in its turn, was instantly seized by a pike. The line was drawn in, the pike continuing its hold upon the small fish till near the water's edge, when it suddenly leaped from its victim, and threw itself on the bank, when both pike and roach were captured. The pike weighed nine pounds; and, on opening it, in its stomach were found three small fish, a water-rat, and a young moor-hen."

Great Size and Astonishing Age.

The voracity of the pike is connected with its rapidity of growth, which necessitates an abundant supply of nutriment, and involves at the same time extreme celerity of digestion. A young pike is recorded to reach the length of about eight inches during the first year, to that of twelve or fourteen during the second year, and of eighteen or twenty inches during the third; after this, its increase for several successive years, where stores of food are abundant, is at the rate of three or four pounds a year. Eight pike, of about five pounds each, have been ascertained to devour eight hundred gudgeons in three weeks. Some idea from this may be formed of the havoc this fish must make in the lakes or rivers in which it is plentiful, and of the necessity of encouraging the breeds of inferior fishes, as the bream and others, for its due maintenance.

The pike not only lives to an extreme age, but attains to extraordinary

dimensions. Pennant speaks of one ninety years of age; and Gesner notices a pike taken at Hailbrun, in Suabia, in 1497, with a brazen ring attached to it, on which was inscribed in Greek characters, "I am the fish which was first of all put into the lake by the hands of the governor of the universe, Frederick the Second, the 5th of October, 1230." This fish must, therefore, have been at least two hundred and sixty seven years old. It is said to have weighed three hundred and fifty pounds.

In the lakes of North America a species of pike, called the muskallonge, grows to an enormous size. It must not be supposed that the larger pike are, the better is their flesh for the table. Walton rightly says, "Old or



CASES OF SHARK'S EGGS.

very great pikes have in them more of state than goodness, the smaller or middling-sized pikes being, by the most and choicest palates, observed to be the best meat." In warm and sunny weather, the pike mostly swims near the surface, and may be often seen luxuriating in the sunbeams, lulled into a sort of slumber. It is not difficult at such times to draw a wire noose, fastened to the end of a rod or long staff, over its head and body, and land it by a sudden jerk.

The angler or goose-fish grows to a length of four to five feet and weighs from 15 to 70 pounds. Its appetite is most voracious and it feeds upon all kinds of fish. On its head are two elongated bony appendages, curiously articulated to the skull by a joint and capable of movement in any direction. The fish crouches close to the bottom of the sea and by the movement of its pectoral fins stirs up the sand and mud, and agitates the bony appendages amid the turbid cloud produced. The small fishes observing the muddy water and taking the filaments for worms approach to seize them and are instantly engulfed in the capacious jaw of the angler. The voracity of the angler is so great, that when caught in a net with other fish, it generally devours some of its fellow prisoners.

One of the mightiest wanderers in the vasty deep is the shark, referred to in a preceding chapter. He has six rows of teeth, which lie down when they are not used; but the moment a fish approaches, up they all start, ready for action. They are very great teeth, nearly two inches broad, and of a three-cornered shape. The edges are like a saw, and as sharp as the sharpest knife.

No creature, not even man, has much chance against these terrible teeth. If a man falls overboard from a ship, where these monsters abound, he is almost sure to be swallowed by a shark. For a shark can swallow a man with ease; and he is always following in the wake of the ship, to see what he can get.

The female shark lays two eggs, instead of a great shoal of eggs, as most fishes do. The egg has a kind of horny covering, and there are tendrils, or, as they are called, processes, shooting out from the covering. These tendrils get entangled among the sea-weeds, and so hold the egg in one place, instead of letting it drift into danger. The little fish is doubled up in the egg; but by-and-by it makes its way out, and begins a life of cruelty and plunder, as its parents did before it.


We need not wonder that the shark is so dreaded by the sailors. In the midst of the tempest, when the winds are howling, and the night is without moon or stars, a shining light will here and there be seen heaving on the billows. The sailors know full well what it is, and point it out to each other.

The light comes from the scaly body of the shark, which is close at hand. If a seaman is washed overboard, or if the vessel should be wrecked, the shark has a banquet.

CHAPTER VIII.

LIFE AT THE BOTTOM OF THE SEA.

Creatures that Manufacture Limestone—Definition by Professor Dana—Marvelous Builders in the Ocean—New Polyp Growing out of the Side of the Old One—Coral Insects in All Seas—Luxuriance of Coral Life in the Pacific—Varieties of Coral—How the Little Architects get their Materials—Rearing Islands from the Bottom of the Deep—The Bermudas once a Coral Island—The Sea-Cucumber—Strange Oriental Food—Harpooning Sea-Cucumbers at the Depth of a Hundred Feet—Hundred-Armed Sea-Star—Amazing Power of Reproducing Lost Limbs—Stomachs that go by the Name of Fish—"Five-Fingered Jack"—Scavengers of the Ocean—Death on Oysters—How the Star-Fish gets into an Oyster's Shell—Droll Polyps—Animal-Plants—Actinia—Enormous Mouth—Sea-Anemones—Voracity Unparalleled—Life Multiplied by Tearing the Body in Two—Astonishing Tenacity of Animal Life.

HE coral polypi are remarkable for secreting a limestone support or coral stock. Coral is the stony frame which belongs to polypi and may be called their skeleton. Professor Dana calls it the corallum and the coral of a single polyp in the mass is called the corallet. It is formed within the coral animals by secretion, each individual adding to the common structure by the involuntary secretion of calcareous matter.

The corals are the results of a growth analogous to that of the bones in other animals. Coral is a carbonate of lime, like common limestone, and it is taken by the polyp from the sea water or from its own food. Coral polyps produce eggs and young, like other animals, and also multiply through a process of budding, which is like the growth by buds in the vegetable kingdom. A new polyp commences as a mere prominence on the side of an old one; soon the mouth and tentacles appear, then both continue growing, each adding to the calcareous accumulation within and each sending forth new buds to be developed into new polyps. In many species of the coral family each branch terminates in what is called the parent polyps, these terminal polyps continuing to grow on and at the same time making new polyps for the sides of the branch by budding.

In the brain coral, instead of each polyp having a separate cell with its mouth over the centre of it, there are a large number of polyps coalesced along a single furrow and a row of tentacles along either side. Among



CORAL ARBOR AND MYSTERIOUS CUTTLE FISH.

the tribes of corals some species or other are found in all oceans from the equator to the polar regions and to the lowest depths explored by man. Those tribes, which produce the great coral reefs, the astræas, madre-pores and meandrinæ are developed with peculiar luxuriance in the warmest parts of the Pacific, where the temperature varies from seventy-five to eighty-five degrees. The higher the temperature the greater is the profusion and variety of the coral reefs. The different varieties of coral consist almost solely of carbonate of lime. There is a small portion of animal matter and also of phosphate of lime.

Skill of the Builders in Selecting Materials.

The soluble salts of sodium, which form the greater part of solid matters contained in sea water, are rejected by polyps and only those materials are made use of which are best fitted for producing the most substantial structures. By their removal the waters of the ocean are kept of uniform composition. The soluble impurities poured into them by the rivers, but for some such provision, would accumulate, as the fresh water alone is carried off by evaporation.

The coral animals and marine shells are the agents destined to keep pure the waters of the great deep, to take up and store away the excess of the lime salts and preserve the balance in this department of nature, as the vegetable growth performs a similar office in keeping down the excess of carbonic acid in the atmosphere.

The ocean currents spread their waters among the coral groves as the winds convey the air through the forests. The coral which is used in jewelry is called precious coral. It is mostly obtained in the Mediterranean, the Barbary coast furnishing the dark-red, Sardinia the yellow or salmon colored, and the coast of Italy the rose-pink; in Europe and America the latter is most valued, while in the Orient the dark-red is preferred. The coral fishermen with large rude nets break off the coral from the submerged rocks.

Magnificent Coral Reefs.

Coral reefs are abundant in the West Indies, but still more so in the Central Pacific, where there are a much greater number of species of corals. Along the Brazilian coast as far south as Cape Trio coral reefs are found. Dana divides coral reefs into outer or barrier reefs and inner reefs. The barrier reefs are formed from the growth of corals exposed to the open seas while the inner or fringing reefs are formed in quiet water between a barrier reef and the island. As coral reefs are usually built upon islands which are slowly sinking, barrier reefs are simply ancient fringing reefs formed when the island stood higher above the sea; they are built up as

rapidly as the land sinks and thus the top of the reef keeps at the level of the sea.

Darwin has estimated that some reefs are at least 2000 feet in thickness. The Bermudas are the remnants of a coral island (Atoll) and are situated farther north than any other reefs.

Sea-Cucumber or Trepang.

Sea-cucumbers have a slightly cylindrical body, sometimes vermiform, provided with numerous tentacular suckers. At each extremity occurs an orifice. The mouth occupies the anterior extremity; it is surrounded with very complex branching tentacles, which the animal can completely draw in, and which are set upon a circle of bony pieces.

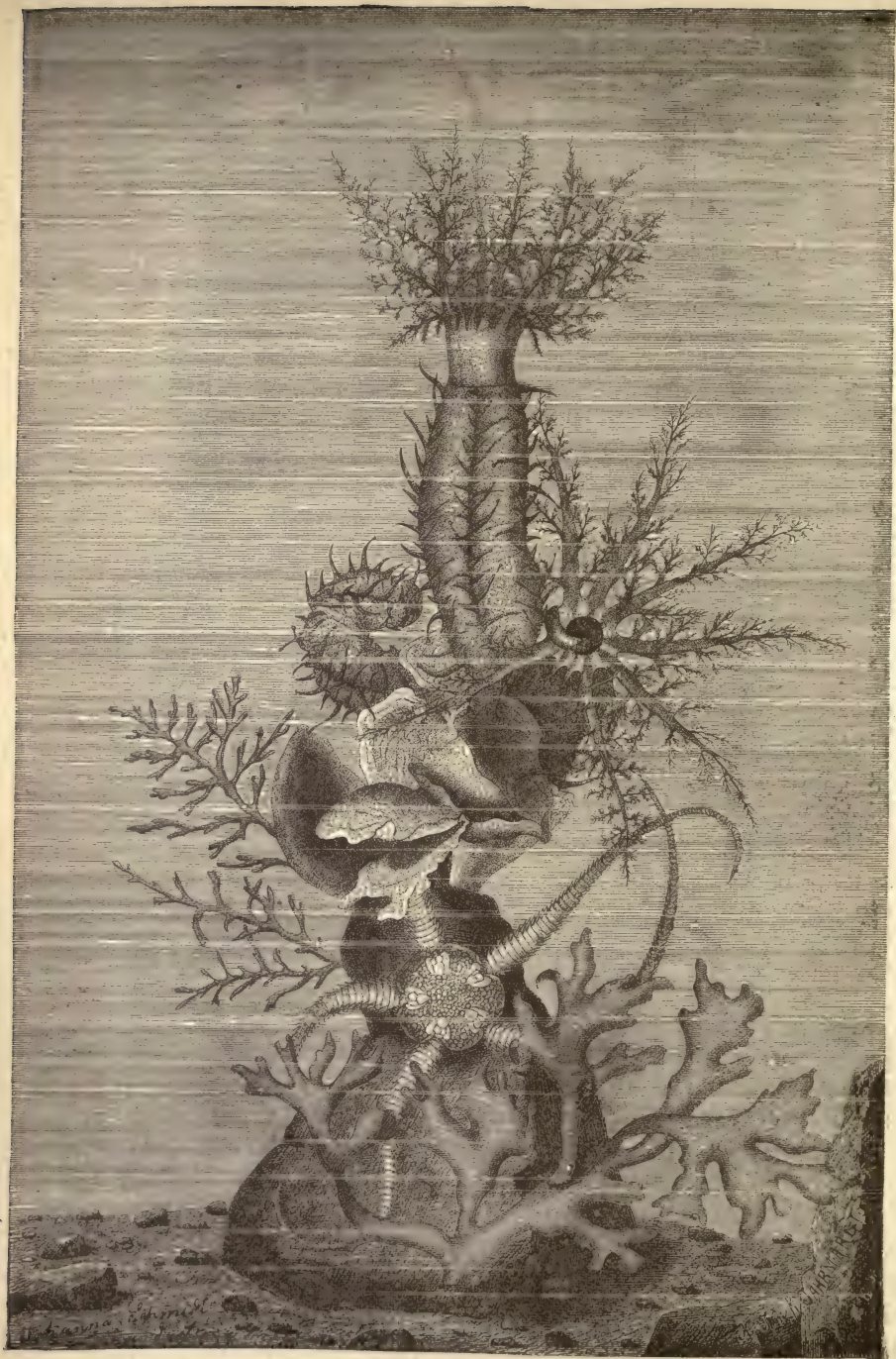
The circulatory apparatus of the holothurians, or sea-cucumbers, is exceedingly complicated, their digestive tube is very long, their secretory organs are numerous, and their muscles powerful. When disturbed, they sometimes contract themselves so violently as to burst asunder, and vomit forth their intestines. There are holothurians in every sea, and several species which live on weedy and surf-beaten rocks. One of the largest species lodges and nourishes a curious parasitical fish. In some countries the coriaceous substance of these animals is used for food. The poor inhabitants of the Neapolitan coast consume it largely; and the Asiatic people seek with avidity a species of holothuria to which they ascribe peculiar virtues.

Long famous under the name of "trepang," bestowed upon it by the Malays, this holothuria is the staple of an extensive commerce between all the Indian islands of Malaysia and China, Cambodia and Cochin-China. Thousands of Malay junks are equipped yearly for the fishing of the zoophyte, and English and American ships are engaged in its sale.

The trepangs of the inhabitants of Sumatra form one of the most considerable branches of the coasting trade between Borneo, Sumatra, the Moluccas, the Papuan lands of Malaysia and China.

A Harpoon a Hundred Feet Long.

For the rest, their substance, according to travellers, has no special flavor, at least if the taste be not masked by the enormous dose of spices or aromatic substances with which the Malaysians overload their food. The fishing for holothurians requires great patience and dexterity. The Malays, bending over the prow of their boats, hold in their hands several long bamboos arranged like the joints of a fishing-rod, the last joint terminating with a sharp hook. At the favorable season, that is, in the calms, the eyes of these skillful fishers pierce the depth of the waters, and easily discover, at a distance frequently not less, as we are assured,



than 120 feet, the holothuria clinging to the coral or rocks. Then the harpoon, descending softly, strikes its victim; and the Malay rarely misses his aim.

Sea-cucumbers are generally small on the coast of New England, but attain a larger size in the Bay of Fundy and on the Banks of Newfoundland. On the mud flats of the Florida reefs they are sometimes seen more than a foot long and three or four inches in circumference. Where collected for food, the taking and preparation of the trepang employ a great many Chinese, Malays and Polynesians.

The best are found on reefs of mixed coral and sand in the Feejee groups in one or two fathoms of water, and are obtained by diving. They are boiled in their own liquid, then dried on stages in heated houses, and meet with a ready sale at high prices in the Chinese markets as an ingredient for rich soups.

Asterias or Sea-Stars.

The species of star-fishes common on our coasts has the form conventionally given to the celestial stars upon banners and in heraldic designs. The rays, which are commonly but erroneously taken for claws, and which really form a part of the animal's body, are generally five in number, united very symmetrically round a central disk. In some species the rays are greatly multiplied, and amount to as many as thirty and upwards. They then become looser, more elongated, and more flexible, giving the animal the appearance of a hairy root.

The upper part of the body is covered with a hard, thick skin, wrinkled, and of a reddish color. The lower part is whitish, and when the animal is alive, you may see there, moving to and fro like worms, its innumerable tenacles. Its mouth is in the centre. Ehrenberg is inclined to believe it also possesses an organ of vision.

The sea-stars, often very small, and more rarely of medium size, are all, as their name indicates, inhabitants of the ocean-waters, and are found at various depths; but many among them belong to the shore, and the tide at its ebb frequently leaves them high and dry upon the land. A great number of species are known as distributed in every sea, and more generally in the tropical waters. The asterias proper, when arrived at an adult age, move with tolerable rapidity, either swimming or crawling.

These radiata feed on dead or living animal substances; they are very voracious; their prey has sometimes been found whole and undigested in the stomach. They frequently banquet upon mollusks. In the spring, and at the beginning of summer, their ovaries swell consid-

erably; they deposit their spawn in suitable localities, and especially upon sandy shores exposed to the solar rays; it is this spawn, we are told, which renders mussels dangerous as food at a certain season of the year. On shores where they are very abundant, the country people collect them to manure the ground; it is the only advantage which man can derive from them.

Lost Limbs Growing Out Again.

The most remarkable feature in the organization of the asterias is their power of reproduction. One, two, three of their rays may be crushed without endangering not only their existence, but even the integrity of the individual. Provided that but one remains attached to the central disk, these losses are easily repaired. It seems that in certain cases the shedding and renewal of the rays are spontaneous. This marvelous faculty would seem to indicate, among the asteriæ, a very intense vitality. One cause of death, however, they cannot withstand for many hours; namely, banishment from the sea. Left by the ebb upon the shore, they cannot live. Even in the captivity of the aquaria they sicken and die, either for want of prey, or because they miss the movement of the incessantly renewed waters.

A common species, found on the coasts of New England, and generally called "five fingered Jack," are but walking stomachs; their office in the economy of nature being to devour all kinds of garbage, which would otherwise accumulate on the shores. They eat also living crustaceans, mollusks, and even small fish, and are believed to be very destructive to oysters. They are not used as food.

The common star-fish of the North American coast is considered to be the same as the European species. The colors vary from reddish to yellowish, and the diameter from an inch to more than a foot. The snake, or sand star is another species. In most seas a very singular species, the arborescent star-fish is found.

A Wonder of Bodily Construction.

It is a pleasant sight when one of these animals is placed in a glass vessel containing sea-water, and its various movements are attentively watched. Then it will be seen that it has, in fact, several hundreds of the sucker-like legs, each one a perfect tube, which, when the animal wishes, becomes filled and extended, while the fluid is as readily withdrawn into the vesicles of the body. We have heard of Argus with his hundred eyes, and of Briareus with his hundred hands, but we are not told that each eye could find a separate object to contemplate, or that each hand could be employed in some distinct manipulation. It seems, however, as if each



BEAUTIFUL SPECIMENS OF STARFISH.

leg of this animal had an independent action, being capable of darting out in various directions, as if, like a living lever, it were seeking the best fulcrum, to render its highest service to the movement now taking place.

In the possession of a sea-star it is very easy to witness its voracity; for only let a morsel of fish or of a mollusk be placed within reach, and thither it will go clasping the prey as soon as it is gained with its rays, and absorbing it into the stomach, to which there is an opening on the other side. In the eagerness it thus manifests it fulfills its appointed destiny. It is one of the scavengers of nature, ordinarily working silently in the deep waters, devouring, from tide to tide, the ever-accumulating matter, which, left undisturbed, would destroy every species of life. So strong is the predilection of these creatures for garbage, that the angler has frequently wished they would suspend their vocation, since scarcely has the baited hook sank to the bottom of the water than he has felt "a bite," only to find that he has caught a sea-star—a luckless beginning, perhaps, of a series of disappointments the same in kind.

Oysters Suddenly Paralyzed.

Might we suggest a banquet for a party of sea-stars, it should be the contents of an oyster barrel, without any specification of the spot where it was filled. "But how," it may be asked, "can their shells be opened? In what way can the resistance of the abductor muscles be overcome? Where is the oyster-knife of the sea-star for the banquet you propose?"

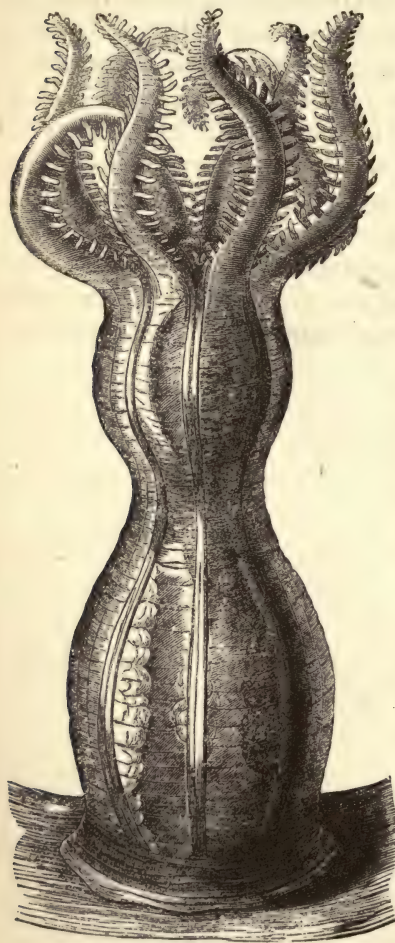
And assuredly it is not, as Appian imagined, in one of its rays. The supposition of the ancients that the sea-star, like a besieging force, took up a position that would secure the best point of attack, and, seizing the moment in which the oyster unwarily opened, however slightly, the valves of his shell, thrust in a ray, gradually insinuated its whole body, and so devoured the assailed—a notion which was also entertained by Bishop Spratt—has proved to be utterly fabulous. For, having reached an oyster by its locomotive power, and placed itself on its prey, it pours out a paralyzing fluid, and instils it between the shells; as soon as they are open, the stomach is thrust in, and the captive is devoured, however long his house may have been his castle.

A sea-star was found clinging round a shell-fish which was pierced with a hole, through which the creature had inserted a sucker, and this aperture was attributed to the invader. But we have no proof that this animal possesses any boring power. The probability is, therefore, as Professor Forbes suggests, that the hole was pierced by a marine worm and that the sea-star, in this instance, was merely "sounding with its sucker the prospect of a meal."



MARVELOUS PLANTS AT THE BOTTOM OF THE OCEAN.

Polyp was a name formerly applied to the three classes of radiata, the coral animals, jelly-fishes and echinoderms; it is now generally restricted to the first class, called zoophytes. Polyps are radiated animals usually attached at the base with a coronet of tentacles above and a toothless mouth at the centre and an inner alimentary cavity, to which the mouth



CURIOUS POLYP.

is the only opening. They reproduce by buds or eggs and possess no special organs of sense. The *Monoxeia Darwinii*, which our illustration represents, was discovered and described by Prof. Hæckel, of the University of Jena. The actinia or sea anemone is the type of this class, the different kinds of actinia and coral polyps having the same general shape and structure. They are of a somewhat oblong form and when closed resemble a truncated cone. They are fixed by the base and from the upper part of their body occasionally extend several tentacles, which are arranged in regular circles. The mouth is situated at the top in the centre of the tentacles. They are capable of varying their figure, but when their tentacles are fully expanded, they have the appearance of full-blown flowers. Many of them are of very beautiful and brilliant color. They feed on shellfish and other marine animals, which they draw into their mouth by means of their arms and they eject the shells and other indigestible parts through the same opening.

The mouth of these animals is capable of great extension so as to allow them without injury to swallow very large shells. The whole interior of their body is one cavity or stomach. They have the power of progressive motion, but this is extremely slow and is said to be performed by loosing their base from the rock, reversing their body and using their tentacles as legs.

The common sea anemone (actinia) is to be found between tide marks on rocks under sea weeds or in tidal pools, but grows most luxuriant on the piles of bridges. The actinia is the type of the single polyps as distinguished from the compound coral polyps.


It is a curious fact that the sea-anemones, of which there is a great diversity, are like Achilles, invulnerable except in one spot. They will bear an extraordinary amount of cutting and tearing, if only the base is kept unlacerated. Exquisite little creatures, torn in two by the splitting of the stones on which they rested, have displayed each half acting as vigorously as if nothing had interfered with its integrity. In the course of some weeks not a trace was left that they had ever been wounded. The Abbé Dicquemare relates that he cut an anemone in two transversely, when the upper portion instantly expanded its tentacles and began feeding; in about two months tentacles began to grow from the cut extremity of the other portion, and thus he obtained two perfect anemones in the place of one. How marvelous is the tenacity of animal life!



CHAPTER IX.

EXTRAORDINARY TURTLES AND CRUSTACEANS.

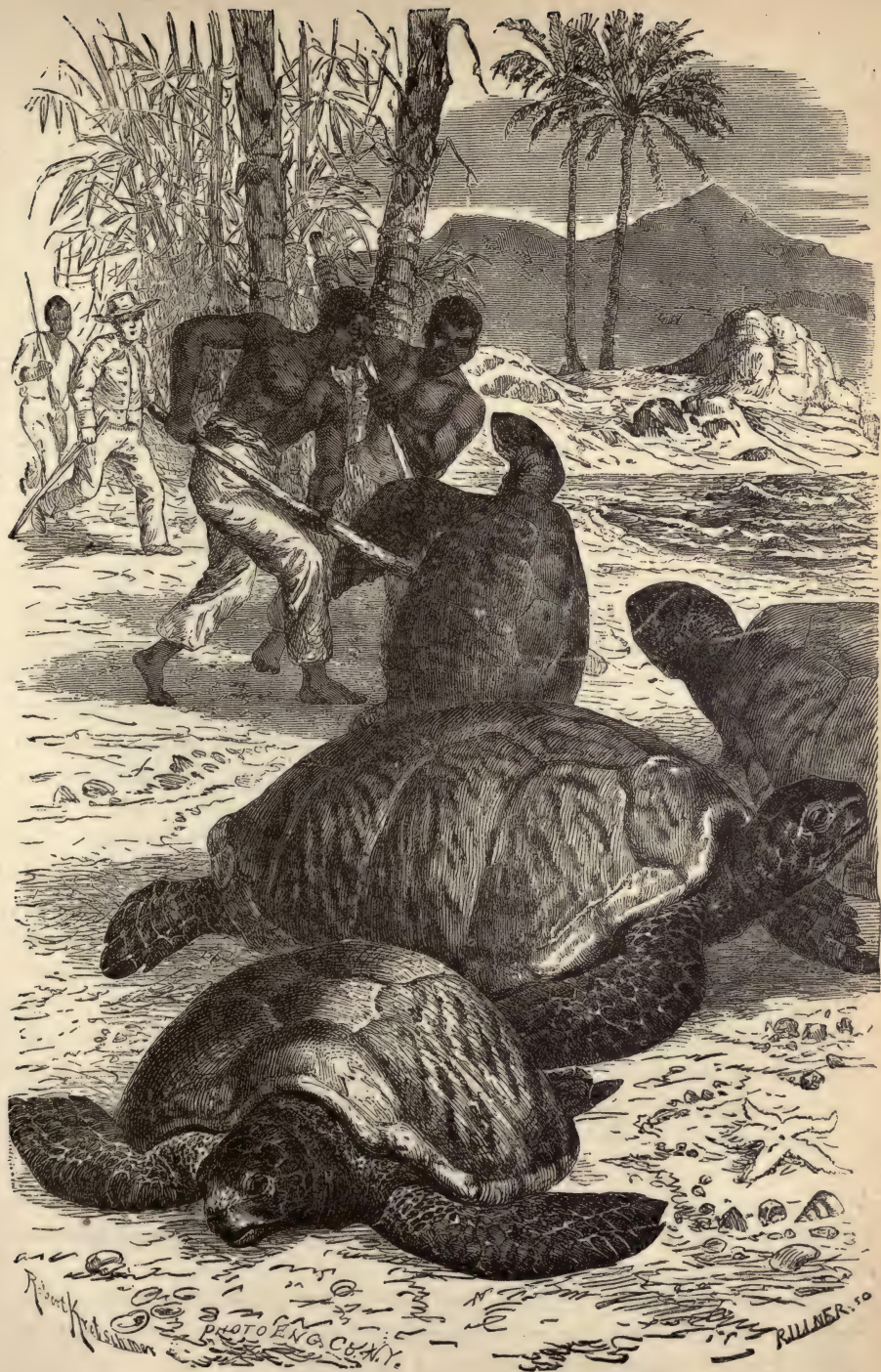
The Great Marine Turtle—A Creature Born with Oars and Paddles—Swift Swimmer—Dozing on the Water—Turtles' Nests in the Sand—Curious Youngsters—Rushing by Instinct for the Sea—Turtle Hunting—Delicious Food—Haunts of the Green Turtle—Natives Lying in Wait—Human Cruelty—Coriaceous Turtle—The Bony Lobster—Monstrous Pincers—Powerful Weapons—A Propeller Tail—Shedding the Old Crust—Escape from the Prison—New Growth of Shells—The Numerous Crab Family—Singular Creatures—The Pea Crab—Hermit Crab—Looking Around for a New House—Moving into the New Dwelling—Tussle between a Shrimp and Crab—Where Crabs Abound—Crab Sentinel Standing Guard—Casting off Broken Limbs—Horrid Crab of Madagascar—Sharp Points—Strange Land Crabs.

HE group of marine turtles has the structure so modified as to be well adapted to all the animal's habits. Its limbs are resolved into strong oars and paddles, which it uses with great dexterity, propelling itself with surprising power and swiftness—the green and hawk's-bill turtles in particular,—“and,” says Audubon, “remind you by their celerity, and the ease of their motions, of the progress of a bird in the air.”

The food of the green turtle consists of marine plants, especially the sea-wrack; and, like cattle in a meadow, it grazes at the bottom of the sea, where it can remain for a considerable time, its nostril being furnished with a valve which closes when in the act of diving; and it is furthermore sustained by the large extent of its lungs, as also by the moderate demands of a slow circulation. It has sometimes been seen in the act of floating on the surface of the water, as if indulging in a sleep, sweetly induced by the gentle undulations of the waves; and its captors have been known to take advantage of this habit, by then making their approaches, to surprise and take their prey before it has time to effect its escape.

The marine turtle inhabits a wide range of the torrid zone, and the shores of the Floridas, many of the West India Islands, and the Indian Ocean, the Isle of France, and the Gallapagos, are the places of its most noted resorts.

We come now to advert more particularly to the most entertaining, the most curious point, in the history of the marine turtle. The young turtle comes from an egg which is hatched, not at home in the sea, with which



NATIVES CAPTURING IMMENSE GREEN TURTLES.

the mother is allied both by habit and structure, but on land, which is quite foreign to her nature. She comes out of the ocean, from a very long distance—hundreds of miles even—to search on the shore for a place suitable, not to any individual want of her own, but to the process of incubating her eggs; and, somehow or other, she always happens to find those localities which offer all the required conditions. A low, sandy, and solitary beach is the kind of spot she seeks for making her nest.

To perform this duty, she starts on her voyage in the early part of the summer, traversing the sea, not individually, but collectively, in a multitude; the females being accompanied by the males as far as the precincts of the land. After sunset, the former leave the water, drag themselves inland over the beach, make their nests in the sand beyond high-water mark, lay their eggs in large numbers, and there leave them in charge of the sun, whose fostering influence is said to bring forth the brood in the course of from twenty to thirty days. The young turtles appear with shell unformed, and white as if they had been blanched. At once all seem to understand that they are away from home, and their only effort is to get as quick as possible into the sea, apparently as well acquainted with the way to it as if they had traversed it a hundred times before. They enter the ocean of less size than a dollar, and no more are they seen out of it until a weight of four or five hundred pounds has been attained; but how long such a size requires, and where all that time is spent, are questions that will not be easily answered.

Cute Device for Hiding Eggs.

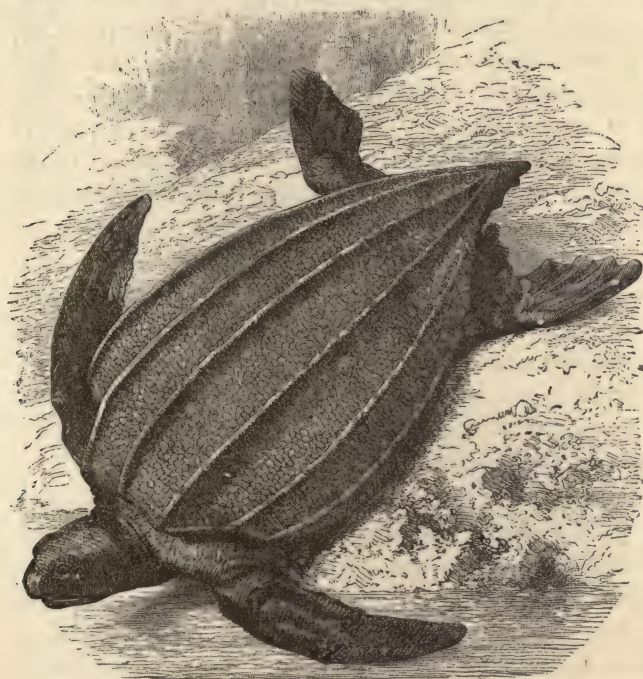
According to Sir J. E. Tennent, and no doubt he is correct, the turtle forms a curve in going to and from the sea, as if seemingly aware that such a direction was the one most likely to deceive the depredator. An opportunity is afforded on the sea-shore of Ceylon for observing a remarkable illustration of instinct in the turtle, when about to deposit its eggs. As if conscious that if she went and returned by one and the same line across the sandy beach, her hiding-place would be discovered at its farthest extremity, she resorts to the expedient of curving her course, so as to regain the sea by the different track; and after depositing her eggs, burying them about eighteen inches deep, she carefully smoothes over the surface to render the precise spot indiscernible. The Singhalese, aware of this device, sound the line of her march with a rod till they come upon the concealed nest.

Though previously timid and suspicious, yet during the time of laying her eggs the turtle may be approached and even mounted; still, for all that, she remains unaffrighted and immovable.

Persons who search for turtles' eggs are provided with a light stiff cane, or a gunrod, with which they go along the shores probing the sand near the tracks of these animals, which, however, cannot always be seen, on account of the winds and heavy rains that often obliterate them. The nests are discovered not only by men, but also by beasts of prey, and the eggs are collected or destroyed on the spot in great numbers, as on certain parts of the shores hundreds of turtles are known to deposit their eggs within the space of a mile. They form a new hole each time they

lay, and the second is generally dug near the first, as if the animal were quite unconscious of what had befallen it.

It will readily be understood that the numerous eggs seen in a turtle on cutting it up could not be all laid the same season. The whole number deposited by an individual in one summer may amount to four hundred, whereas, if the animal is



CORIACEOUS TURTLE.

caught on or near her nest, the remaining eggs, all small, without shells, and as it were threaded like so many large beads, exceed three thousand. In an instance where that number was found, the turtle weighed nearly four hundred pounds. The young soon after being hatched, scratch their way through their sandy covering, and immediately betake themselves to the water.

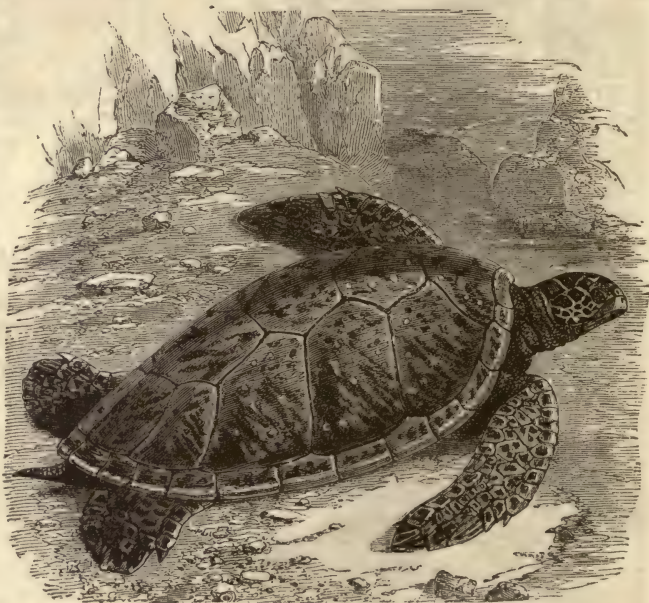
The green turtle sometimes attains a length of five to six feet and a weight of 500 to 600 pounds. It received its name from the color of the delicious fat, which enriches the soups and other dishes of turtle. It is abundant in the tropical waters of the torrid

zone, whence great numbers are exported alive to the Northern States and Europe.

As the turtles find constant abundance of food, they have no occasion to quarrel with animals of their own kind. They flock peaceably together, but they do not seem to have any kind of associations, like many other herding animals. The legs of green turtles bear so great a resemblance to fins, as to afford them little service, except in swimming.

The old females, notwithstanding they only come on shore in the night, in order to deposit their eggs, are often caught by the natives, who are in waiting about their haunts and who either kill them by blows with a club or turn them over on their backs.

It sometimes requires the efforts of several men, to turn one of them over and then they must employ handspikes or poles for that purpose. The back shell in this species is so flat as to render it impossible for the animal to recover its proper position when once it is thrown upon its back.



EDIBLE TURTLE.

The coriaceous turtle, is distinguished from the rest, as its name implies by the peculiar nature of its shell, which consists of a coriaceous or leathery substance, checked over its entire surface by numerous hexagonal and pentagonal markings, which, however, are so lightly traced as in no wise to impair the general smoothness. Five strongly prominent ridges traverse the whole length of this leathery cuirass, and there is no under or thoracic shell. The color is a dusky brown, paler on the inferior parts. The tail is short, and sharply pointed; a strong leathery skin covers the large, long legs; the head is large, and the upper mandible so singularly notched at the tip that it resembles two large teeth.

AMERICAN LOBSTER AND SPINY LOBSTER.



This species of turtle inhabits the Mediterranean, and has been found at times on the French and English coasts. It occasionally wanders as far as the shores of South America and Africa. Some individuals measure seven and eight feet in length, and weigh a thousand pounds.

The edible or green turtle is one of the largest of the genus, measuring above six feet in length, and weighing from five to six hundred pounds. Its shell consists of thirteen dorsal segments or divisions, surrounded by twenty-five marginal pieces, and its form is somewhat heart-shaped, or like the shield worn by mediæval soldiers. Its color is a dark brown.

The Bony Lobster.

This is an example of a genus of crustaceans, remarkable for their long tails and tremendous claws. It is found in the greatest abundance on our coasts, in clear water of no very great depth, at the time of depositing its eggs, about the middle of summer. The head and thorax of this creature are blended, as in the scorpion, into one portion, which is covered by a dorsal shield or carapace above, and below by a narrow plastron, to the sides of which the legs are attached. The first pair of limbs are remarkably developed, possessing great power; and the last joint consists of large pincers, acted upon by voluminous muscles, and capable of inflicting severe injury. The two pairs of pincers differ in form and use. The left hand pair have their opposing edges firmly dentated, and are employed in seizing and cutting the prey. The right hand pair seem destined for holding, anchor-like, on any fixed objects, and thus mooring the animal amidst the dashing of the tempest-tossed waters. Of the four succeeding limbs on each side, the first two end in small pincers; the rest are simply pointed.

Along the under surface of the tail are what are called false feet. Of these there are five pairs. These false feet assist, perhaps, in swimming; and in the case of the female, are of use in enabling her to affix the eggs or spawn, by means of a glutinous fluid, to the under surface of the abdomen. In the lobster, and other species of the group, the tail is the great organ of locomotion, and hence the extraordinary development of the muscles composing its internal structure.

Getting a New Dress.

Clad in hard, unyielding armor, to which, when once formed, no addition, by way of growth, can possibly be made, a lobster changes its calcareous investment at certain intervals, until it is fully mature. Nay more, the covering of the eyes, the cornea, the lining membrane of the stomach, with the teeth, and also the semi-tendinous expansions to which the muscles of the claws are attached, are all periodically thrown off. It is only

when released from their armor that these animals increase. The soft body, liberated from its close imprisonment, suddenly pushes forth its growth; the vital energies are, as it were, summoned to the task of enlarging the frame, and a new investment is acquired, to be again cast off at the appointed period.

One of these changes is described by Couch. The manner in which the lobster escaped was not to be mistaken. Through the middle of the carapace, or coat of mail, ran a line as straight as if it had been cut by a knife; and evidently formed by a natural process of separation, for it even proceeded through the centre of the snout to the terminal pointed process, at the root of which it turned off on the right side; so that the least effort of the animal was sufficient to afford it a passage.

Sometimes lobsters throw off their claws in consequence of fright, and often they will hold on to an object till the claws are torn off. To some extent these lost parts are reproduced. They are very active in the water, and can spring to a considerable distance; they feed chiefly at night. They are voracious, and eat any animal matter that comes in their way. Immense numbers of the European lobster are taken, but the means of increase are abundant, twelve thousand four hundred and forty-four eggs having been found under the tail of a single female. The common American lobster, abundant on our coasts from New Jersey northward, is used in very large quantities; it is nearly twice the size of the common European species, weighing from two to thirty-five pounds; the average weight, however, being four pounds.

The Great Shore Crab.

This crustacean may frequently be met with. The French, who are as familiar with it as we are, call it very properly *le crabe enragé*; for only attempt to touch it, and it will run along the sand, greatly excited. Seize it before it can succeed in burying itself, its claws become defiant, it will try with all its might to seize and pinch the fingers in which it is held; and if it has no other resource, will leave you grasping a claw or claws, and make off as if it suffered no pain. Any or all of these legs may be thrown off on the suffering of injury, but not with equal facility in all the species; for in some, as in the common crab, if they be crushed or broken without great violence, they are sometimes retained, and the crab will in no long time bleed to death. To save the crab the fishermen proceed to twist off the limb at the proper joint, or give it a smart blow, when it is rejected; and in either case the bleeding is stopped.

According to Couch, casting the shell of the common crab takes place by a separation of the dorsal from the lower part of the carapace;



CRABS WASHED ASHORE BY A HIGH TIDE.

the animal lying on its back during the process. Prior to this in the crab, and probably in the lobster and others, the fleshy contents of the limb-cases shrink very considerably; otherwise, the flesh could not be extricated, for it does not appear that their shells are fissured. The newly extricated crab—not unlike a lump of dough inclosed in membrane—has, at first, strength to crawl to some hole as a place of safety; there it absorbs as much fluid as will distend its organs and their common covering, now flexible as velvet, to the full extent of their capacity. Thus the deposition is made of the calcareous crust, according to the newly-acquired bulk of the animal, which is proportionately the most increased in the youngest individuals.

The Pea Crab.

The pea crab is another curious creature, very commonly found in the common mussel, and especially in those taken from rather deep water. "On one occasion," says Bell, "I dredged great numbers of these mollusca on the coast of Dorset, and found by far the greater number of them with one or two of these little soft-bodied crabs within their shells; for the females are much more common than the males. The latter sex I have occasionally taken apart from the mussel-shells; the former never. They also occasionally inhabit the common cockle, in which I have now and then found them, as well as very rarely in the oyster." The velvet crabs, so called from the velvety substance with which the shells are covered, and which extends even to the limbs of the animal, are among the most beautiful in appearance. They are of a reddish color, tinged with blue. One of them, very commonly found, has colors remarkably bright; it is about two inches and a-half long, and much esteemed for food.

The Hermit Crab.

The hermit crabs have the whole hinder part of the body covered with a coriaceous membrane, instead of a hard, calcareous armor. Apart, then, from special defence, how could they escape being bruised and broken among the rough stones of a rocky beach, when a rolling tide lashes the shore, or becoming an easy prey to their enemies? But instinct supplies all that is required. The hermit crab selects an empty turbinate shell fitted to its size, when, introducing its tail, it retreats backwards, and in the recesses of its appropriated dwelling finds security. It is only the right of one of its pincer claws that is largely developed, and with this it both shuts and guards the entrance to its home, the caudal paddle of other creatures being unnecessary in this instance. It is changed, in fact, into a sort of anchor, by which the hermit crab retains a firm attachment to the bottom of his dwelling. Here secure, he peers out in quest of prey;

and, carrying his castle with him, may be seen, often with others, enjoying his repast.

Unlike the univalve or bivalve, which enlarges its dwelling on increasing its size, the hermit crab, when grown too large for its dwelling, seeks and finds a more spacious tenement. In no race of beings is such a practice known as this. Peculiar, however, as is their sagacity, one species is specially remarkable for forming so intimate an attachment to the cloak anemone, that the latter being fastened to the hermit crab's



THE AMERICAN GIANT-CRAB,

shell, their mouths are so combined that they always feed together, according most where many other creatures would least agree. On a change of dwelling, the hermit crab has been seen anxiously transferring his friend to his new abode, and even pressing him down with a claw to complete his adherence; and another has been beheld failing to do so, after many efforts, and sooner than give

up his friend, returning to endure the inconveniences of his old dwelling.

Of the crustaceans, however, there is an endless variety; and we give an amusing instance of the green crab's fox-like craft, as related by Quatrefages: One day I threw a large arenicola (lug-worm) into a pool of water several feet in extent. A troop of little shrimps, which were sedately enjoying themselves in the clear element, dispersed in alarm, startled by the noise made by the fall of this strange body, but, recovering themselves in a moment, they rallied, and, while the annelid was endeavoring to bury itself in the sand, one of the youngest, and con-

sequently the most venturesome of the party, seized the creature by the middle of its body.

Emboldened by this example, the others lost no time in imitating it, and the poor arenicola was pulled about in all directions, until a full-grown shrimp, darting from behind a tuft of corallines, dispersed his feebler comrades, and appropriated the booty to himself. I soon saw, however, that he would be compelled to divide the spoil, for at that very instant there poured forth from the moving sand some scores of small creatures, which, conscious that a victim was at hand, wished to participate in the feast. Without any sign of uncertainty or hesitation, they moved straight forward towards the arenicola, whose body was covered in the twinkling of an eye with those voracious mollusks. I thought his fate definitely settled, when a small shore-crab issued from beneath a stone, put to flight the shrimp, and, by dragging off the arenicola, very nearly upset all



GREAT CRAB OF MADAGASCAR.

the others, which forthwith hurried back to their sandy haunts. Then, however, a large edible crab appeared on the scene, and the poor little shrimp was obliged, in his turn, to beat a retreat, in order to escape out of reach of the formidable pincers of his stronger kinsman. But he still kept a watchful eye over the dainty morsel which he had tasted, and, taking advantage of a moment when the larger crab was withdrawing from the field, from some temporary emotion of alarm, he rapidly seized the long-disputed arenicola, and carried it for safety to some distance from the water's edge, where he might devour it at his ease on dry land.

The crab of most importance as an article of food on the Atlantic and Gulf Coast of the United States is the blue crab. This is one of the

swimming species, and is found especially in estuaries and brackish waters from Cape Cod to the Gulf of Mexico. Other species of the same class, found in the West Indies, and on both coasts of Central and South America, are extensively used for food. The rock-crabs are sometimes sold in New England, and similar species are common in California, while another species is much used on the coasts of Europe.

When the claw of a crab is bruised it bleeds, and the animal seems to suffer much pain. For a while it moves it from side to side, and then holding it steady in one direct position, the claw all of a sudden gives a sudden crack, and the wounded part drops off; not at the joint, but in the smoothest part of the limb. Crabs frequently have serious fights by means of their great claws, with which they break or cut off their adversary's legs.

The American crab, with its enormous claws, is about a foot and a half in length. But its appearance is not so terrifying as that of the *parthenope horrida*; a crab frequently met with on the shores of the islands of Réunion, Madagascar, and the Mauritius. Its whole body, its claws and nippers, bristle with hard, long, sharp, and menacing joints. The figure given in our text is a reduced copy from an illustration in Milne-Edward's valuable monograph on the crustaceans of Réunion.



CHAPTER X.

MOLLUSKS WITH PECULIAR SHELLS.

A Choice Mineral Substance—Material for Ocean Builders—"See what a Lovely Shell"—Rare Mollusks—The Young Guarded—Repulsive Creatures in Beautiful Dwellings—The Sea-shore a Great School of Instruction—Curious Pearl Oyster—Helmet Shells—Cone Shells—Gorgeous Hues—Interesting Bivalves—Scallop Shell—Ornament of Pilgrims—Silken "Byssus"—Strange Material for Fabrics—Treasures of the Pearl Oyster—Fondness of the Ancients for a Gem—Shakespeare on the Orient Pearl—Immense Wealth of Ceylon—Pearl Fishing by Cingalese—Picturesque Spectacle—Firing a Cannon at Day-break—Ropes, Knives, and Stones—Three Sieves—Form and Color—Pearls of Every Hue—Allusion of the Historian Tacitus—Origin of Pearls—Emerald Fringes—Marvels of Old Ocean's Bed.

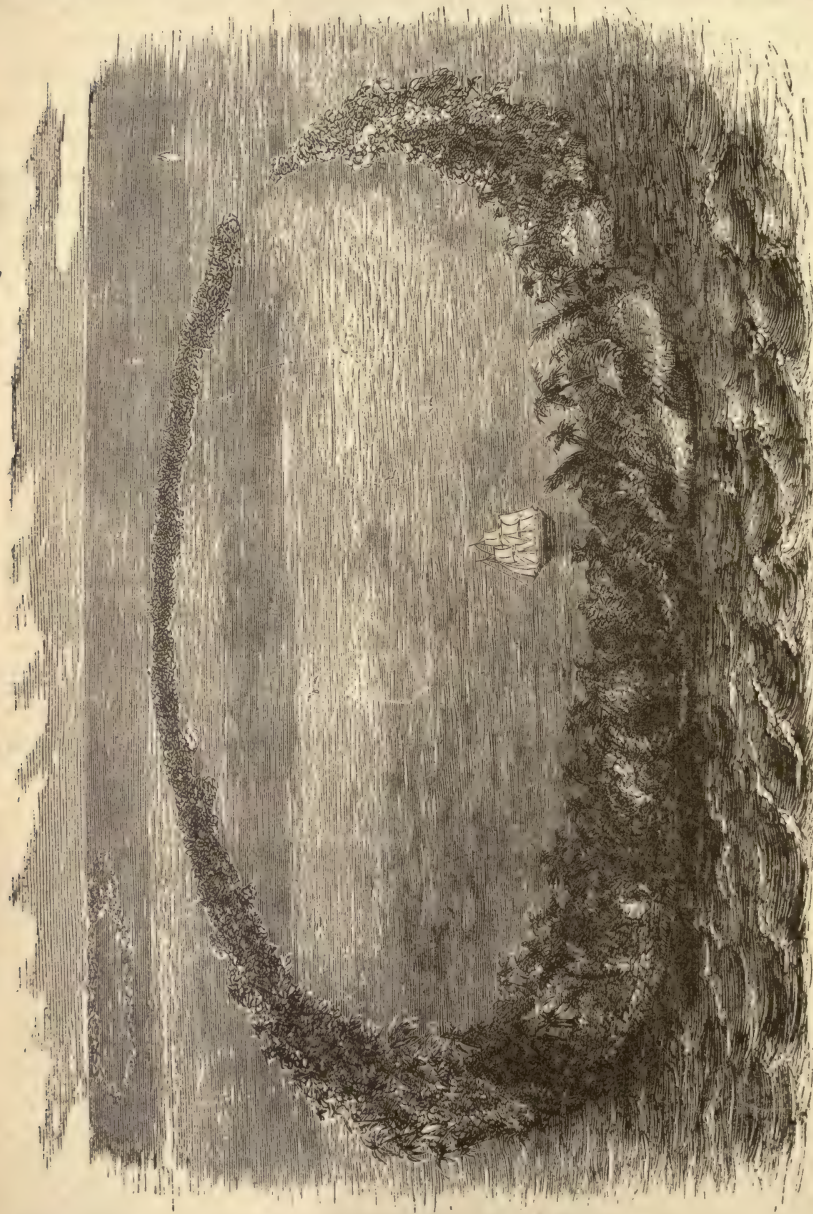


HERE is a certain material spread throughout nature in prodigious abundance; the result of the combination of carbonic acid with lime, and which, according to the rules of chemical nomenclature, is scientifically known as carbonate of lime. This substance plays a most important part in the mineral kingdom, and under the different forms which it assumes constitutes for man one of those sources of wealth he appreciates so much the less because they are indispensable to him, and therefore bestowed by nature with a lavish hand. What is carbonate of lime? Why, it is marl—it is chalk—it is building-stone—it is also alabaster and marble. It is that of which Tennyson sings in these lines:

See what a lovely shell,
Small and pure as pearl,
Lying close to my foot,
Frail, but a work divine,
Made so fairly well,
With delicate spire and whorl,
How exquisitely minute,
A miracle of design!

In the animal kingdom, the same substance absorbed, elaborated, and secreted by those myriads of seen and unseen workmen of which we have already spoken, becomes for them, too, as for us, the matter with which they build and fashion their asylum, their habitation. Carbonate of lime is the outer coat of those innumerable creatures which have aided in building up our capital cities; it is the polypid of the zoophyte, the armor of the crustacean, the house of the mollusk; it is those beautiful shells of all dimensions, of such varied forms, such vivid colors,

with such dazzling reflections, which we justly prize as the admirable masterpieces of the inimitable artist; it is mother-of-pearl; it is the pearl



BEAUTIFUL CORAL ISLAND SURROUNDING A LAGOON IN THE PACIFIC.

itself, sung by poets, and ranked among the most precious gems.

The mollusks would be at once delivered up defenceless to the snares

of their enemies, if nature had not endowed them with the marvelous faculty of constructing a solid envelopment, which serves them instead of a skeleton, since their muscles adhere to it, and in which they can shut themselves up as in a fortress. Only a very small number possess, as a substitute, either a kind of internal shell, or an exceptional vigor and development of their apparatus of locomotion, attack, and defence. Nearly all live entirely in their shells, and perish immediately they are deprived of them. In some cases they are not born with the shell, but no sooner have

they emerged from the egg than the calcareous secretion begins, and in a few moments acquires sufficient consistency to protect the young animal.

The reader will perceive that in the study of so vast a science it is impossible for us to engage ourselves, and that we must be contented with rapid glances at a few of its more remarkable points. But, undoubtedly, the most interesting feature of these



RARE SPECIMENS OF MOLLUSKS.

mollusks, for him who does not pretend to arm himself with microscope and scalpel to examine minutely their anatomy and the functions of their organs, is their shells; graceful and attractive works, whose rich and diverse tints, and elegant forms, contrast so singularly with what we must acknowledge to be the disagreeable aspect of the beings which produce them. An aspect which in very few cases justifies the delicate fancies of the poet:

The tiny cell is forlorn,
Void of the little living will
That made it stir on the shore.

Did he stand at the diamond door
 Of his house in a rainbow frill?
 Did he push, when he was uncurled,
 A golden foot or a fairy horn
 Through his dim water-world?

But of what value would be a description, necessarily dry, incomplete, and inexact, where only the most skilful and artistic brush or pencil can hope to give the faintest realization of the truth? To fully appreciate such objects, and their rare and subtle art, we must see them, must atten-

tively investigate their infinite details, not one of which should escape our notice. This pleasant task we recommend to the reader; it is one which he can easily take upon himself, as every inch of sea-shore is rich in subjects for study, and he may also obtain access to our great public collections.

The wealth of our seas, however, may not be compared to that of the tropical ocean. It is from



MADREPORE ATTACHED TO A MOTHER-OF-PEARL OYSTER.

the latter only we obtain the gigantic fridacnas, some of which weigh five hundred pounds, and are used in Catholic churches as receptacles of the holy water; while the Polynesian islanders convert them into mattocks and other tools. There is also the great triton, from one to two feet long, which serves the savage for a martial horn; the apex of the spire being perforated, a rude music is produced by blowing through the aperture. Other shells are converted into snuff boxes. The nautili, with their pearly secretions are polished and mounted in beautiful opaline vases. We have also the mother-of-pearl

oyster, and the ear-shells distinguished by the pearly iridescence of the interior surface. Then there is a pearl oyster containing the beautiful and costly substance called mother-of-pearl; besides other shells of all forms and sizes, whose enumeration alone would occupy many pages. Mention must be made of the great helmet-shells, characterized by the triangular disk of the inner lip, and by the angulated outer lip—these shells are finely sculptured by Italian artists in imitation of antique cameos; the richly-colored olivas of tropical coasts; the conis with thick shells rolled up, as it were, in the form of a cone, all very elegant in shape, and of glowing hues, and innumerable small ocean gems, so finely wrought that no lapidary can imitate them, and that the eye seizes but slowly all their perfections.

Shells may be divided into three great classes,—the univalves, bivalves, and multivalves.

The former consists of a single valve or piece, which almost always affects a more or less modified spiral form. Nearly all the most beautiful shells belong to this class. We must except, however, the tridacnas, which are bivalves, that is, formed of two symmetrical halves conforming accurately to one another. The most edible shell-fish, such as the common oyster, the pecten, or scallop-shell, worn by pilgrims who had visited the shrine of St. James in the Holy Land, the hippopus (or horse's foot, whose undulating edge, radiated fluted columns, and variegated coloring, command general admiration), the mussel, and others, are likewise bivalves.



1.—HELMET SHELL OF MADAGASCAR. 2.—SPINY ROCK. 3.—SADDLE SHELL.

The organ which secretes the calcareous matter composing the simple, double, or multiple shell, is called the mantle, because the animal can conceal within it, by contraction, most of its other organs. All the mollusks have a mantle; but in some—like the cuttle—it only secretes a kind of internal shell, and in others—the polypus, for example—it is wholly inactive. Among all the conchiferous mollusks, the edge of the mantle remains invariably free and mobile. Certain univalve mollusks

form the opening of their habitation with a kind of horny lid or cover, calcareous and compact.

The mantle of acephalous bivalves produces a number of silky filaments designated the byssus, by which the shell is attached to rocks or other marine bodies. The byssus of certain mollusks consists of elements of greater or less length; but that of the wing-shell, is especially remarkable for its abundance,



1.—BEAR'S PAW CLAM. 2.—SHELL WITH "BYSSUS."
3.—FUSUS LONGISSIMUS.

dance, its fineness, its brilliancy and softness, almost approaching in these qualities to woven silks. The filaments are extremely strong, and the color, a reddish brown, never fades. The ancients fabricated a sort of stuff from these filaments; and in Sicily they are still sometimes manufactured into gloves and other articles of dress.

In Italy, it is made into various articles; and there are few museums without a glove or a stocking woven out of this substance. Some stockings of this silk were presented in 1754 to Pope Benedict XIV. In the

great exhibitions of late years, a large number of articles have been exhibited, manufactured from this substance, as well as specimens of the silk for making up.

Pearl Oysters and Their Treasures.

The passion for pearls was at its height about the period when Roman freedom was extinguished, and in the imperial city pearls were valued as highly as precious stones. A pearl, celebrated in Pliny's time, was bought by Tavenier for \$50,000. In Asia this taste was of more ancient date, nor has it ever declined. A string of pearls of the largest size is an indispensable part of an Eastern monarch's decorations. It was thus that Tippoo was adorned when he fell before the gates of his capital; and the rulers of Persia have for ages been similarly decorated. Shakespeare gives us the following colloquy:

Cleopatra.—How goes it with my brave Antony?

Alexas.—Last thing he did, dear queen,

He kiss'd—the last of many doubled kisses—

This orient pearl;—his speech sticks in my heart.

Cleopatra.—Mine ear must pluck it thence.

Alexas.—

“Good friend,” quoth he,

“Say, the firm Roman to great Egypt sends

This treasure of an oyster.”

The pearl oysters, like those with which we are familiar, lie in banks, at greater or less depths in the sea. Such banks, for example, occur on the western side of the island of Ceylon, about fifteen miles from the shore, where their average depth is about twelve fathoms. Here the greatest of all pearl fisheries has been carried on for many centuries. They seem always to have been considered the property of the king or kings of Ceylon; but since the occupation of the island by the British, the privilege of fishing on them has been sold sometimes by auction, the sales being made only for one season.

The pearl fishery always begins in the month of April, because the sea has then a beautiful tranquility; and is generally continued to the middle or end of May. It attracts to the coast not only a multitude of the Cingalese, but the crowds of speculators from all parts of the vast Indian peninsula, whose variety of language, costume and manners is described as very striking and pleasing. On the eve of the fishery there is a curious and picturesque spectacle.

The signal for beginning the fishing is given at day-break by the discharge of a cannon; on which a countless fleet of boats, that have started for the shore at midnight, and, favored by a land breeze, have reached the oyster banks before dawn, cast anchor in the respective parts for which

their owners have contracted, or at which they are appointed to work. Inspectors are in attendance to prevent any irregularity in these respects.

That they may descend through the water with greater rapidity to the bank round which the oysters are clustered, the divers place their feet on a stone attached to the end of a rope, the other end of which is made fast to the boat; they carry with them another rope, the extremity of which is held by two men in the boat, whilst to the lower part that descends with the diver, there is fastened a net or basket. Every diver is also provided with a strong knife to detach the oysters, or to serve him as a defensive



SHELL WITH BEAUTIFUL PEARLS.

weapon if he should be attacked by a shark. On touching the ground, they gather the oysters with all possible speed, and, having filled their net or basket, they quit their hold of the rope with the stone, pull that which is held by the sailors in the boat, and rapidly ascend to the surface of the sea.

Pearls of an inferior description are formed in a fresh-water bivalve. It is probable that pearls from this source, collected by the ancient Britons, may have given rise to the statement by Tacitus in his "Life of Agricola," of pearls, "not very orient, but pale and wan," being among the indigenous products of Great Britain.

The origin of pearls has led to much discussion, but it should be remembered that the instinct of every shell-dweller is prepared to meet all the exigencies of its being. However rough and rugged be the exterior of its abode—gradually adapted to its growth—the interior is invariably made exquisitely smooth, and often highly iridescent. And should some grain of sand or other substance enter its dwelling, and be likely to irritate its tender body, it wraps it up in the iridescent substance which it secretes at pleasure, and changes it into a pearl!

In our sea-side walks, we may often see—

Rocks, rough with limpets and brown tangle weed,
Jut here and there—whilst on the sturdy cliff
Its cable sure the crafty mussel spins,
Lashing itself for safety to the rock.

Here and there,
Speckled with slaty spots of green, that tell
Where 'neath their emerald fringes cockles hide,
Strange shells, the marvels of old ocean's bed,
Are strewed around. Have they been always here?
Or came they hither from far distant shores,
Unwilling captives of careering waves?

CHAPTER XI.

SHIPWRECKS AND OCEAN ADVENTURES.

The Benefits of the Ocean very Costly—A Devouring Moloch—Human Victims and Horrible Gifts—Rich Cargoes Swallowed Up—Innumerable Human Victims—Ships on Fire—Taking to the Boats—Sailors Familiar with Danger—Horrors of the Great Abyss—Washington Irving's Graphic Description of a Shipwreck—Dismal Stories—Startling Adventures of a Ship Captain—A Drowning Cry Mingling with the Wind—Perils of Arctic Voyages—Loss of the Ship "Jeannette"—Ice Hammering at the Vessel—Melville Taking a Photograph—Hasty Preparations to Leave—Three Boats Lowered—"There She Goes!"—Encamping on the Ice—Boat Mounted on Sleds—Long and Toilsome Journey—Silk Flag Unfurled on Bennett Island—Capturing Arctic Animals—The Great Sea-Cow—"Funny Wee Fishes"—Terrific Battle with Walruses—Fast Loading and Firing—Loss of the "Essex"—Captain Pollard's Vivid Narrative—Repeated Attacks of an Immense Whale—The Ship Stove—Three Little Boats in the Great Deep—A Barren Island—Frightful Sufferings—Again on the Trackless Sea—Miraculous Escape—Rescue of Men from the Island—Horrid Cannibalism—Tornadoes and Water-Spouts—Elements at War—A Thousand Ships Go Down—Wreck of the Royal Fleet—Immense Loss of Life—Huge Cannon Blown Away by the Hurricane—An Appalling Scene.



THE benefits of ocean are immense; but we must own that they are very dearly purchased. Certain ancient races made for themselves deities of the most greedy and sanguinary character; the Moloch of the Canaanites, the Teutates of the Gauls, granted nothing to the prayers of their votaries unless their prayers were accompanied with the most horrible gifts. Perfumes, gold, precious stones, the blood of animals, could not suffice them; they demanded human victims; the more tears these offerings cost, the more they were valued; they were required to be renewed at definite epochs, which however did not prevent the god from insisting upon an increase under certain circumstances. War and peace, harvests, great enterprises, public calamities, were so many occasions for which the poor wretches submitted to the caprices of these monsters to pour out piously the blood of their prisoners, their slaves, their fellow-citizens, even of their own children.

Alas! human sacrifices have not ceased with the worship of these false gods; and it is not only some few barbarous races, but even the most polished Christian nations, the most civilized and the most enlightened, who pay a ghastly tribute to Ocean, the new Moloch. We

do not speak of the ships lost, of the rich cargoes swallowed up—these would be little ; but one trembles to think of the innumerable victims who have perished in the bosom of the waves, and of whom every year increases the funeral record.

If mariners had only the rock, the reef, the hidden shoal, and the tempest to fear ! But so many other dangers threaten, and may at any moment overcome them, even when they imagine their security complete. For those who go down to the sea in ships, no element is more formidable than fire. It can only be extinguished by sinking the vessel, so that the unhappy mariner has but to choose between two kinds of death. There is no refuge, no means of safety, except the boats, into which the panic stricken crew often precipitate themselves headlong, and frequently capsize them by overloading.

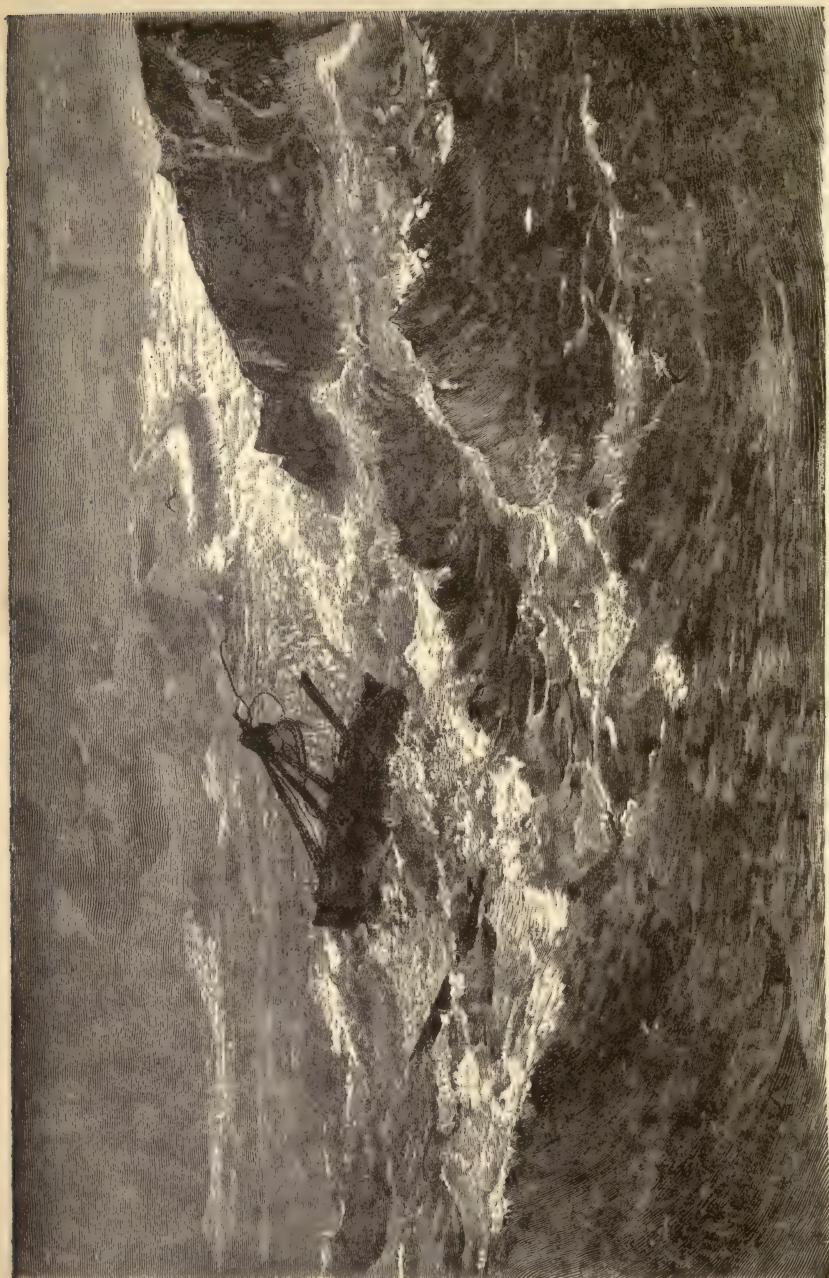
Another too frequent cause of disaster is collision. Two ships at night, or in a dense fog, encounter each other, to the serious injury of both, and usually to the utter ruin of one. This danger would seem the most easily avoided ; and such, indeed, might be the case, if the nautical regulations were more strictly preserved, and if ships in bad weather invariably showed their lights. But men grow familiar with danger, and neglect these precautions, which, moreover, under certain circumstances would still be insufficient.

Washington Irving's Description of a Wreck.

Washington Irving, poet and historian, one of the literary glories of America, has described with his wonted elegance and vivacity the impressions produced upon his mind by his first voyage. We will quote the most characteristic episode of his charming narrative :—

“ We one day descried some shapeless object drifting at a distance. At sea everything that breaks the monotony of the surrounding expanse attracts attention. It proved to be the mast of a ship that must have been completely wrecked, for there were the remains of handkerchiefs by which some of the crew had fastened themselves to the spar, to prevent their being washed off by the waves. There was no trace by which the name of the ship could be ascertained. The wreck had evidently drifted about for many months ; clusters of shell-fish had fastened about it, and long sea-weeds flaunted at its sides.

“ But where, thought I, are the crew ? Their struggle has long been over—they have gone down amidst the roar of the tempest—their bones lie whitening among the caverns of the deep. Silence, oblivion, like the waves, have closed over them, and no one can tell the story of their end. What sighs have been wafted after that ship ! what prayers offered up at



SHIP WRECKED BY A FURIOUS STORM.

the deserted fireside of home! How often has the mistress, the wife, the mother pored over the daily news to catch some casual intelligence of this rover of the deep? How has expectation darkened into anxiety, anxiety into dread, and dread into despair! Alas! not one memento may ever return for love to cherish. All that may ever be known is that she sailed from her port, 'and was never heard of more!'

"The sight of this wreck, as usual, gave rise to many dismal anecdotes. This was particularly the case in the evening, when the weather, which had hitherto been fair, began to look wild and threatening, and gave indications of one of those sudden storms which will sometimes break in upon the serenity of a summer voyage. As we sat round the dull light of a lamp in the cabin, that made the gloom more ghastly, every one had his tale of shipwreck and disaster. I was particularly struck with a short one related by the captain.

The Captain's Thrilling Story.

"As I was once sailing,' said he, 'in a fine stout ship across the banks of Newfoundland, one of those heavy fogs which prevail in those parts rendered it impossible for us to see far ahead even in the day-time, but at night the weather was so thick that we could not distinguish any object at twice the length of the ship. I kept lights at the mast-head, and a constant watch forward to look out for fishing-smacks, which are accustomed to lie at anchor on the banks. The wind was blowing a smacking breeze, and we were going at a great rate through the water. Suddenly the watch gave the alarm of "a sail ahead!"—it was scarcely uttered before we were upon her.

"She was a small schooner, at anchor with her broadside towards us. The crew were all asleep, and had neglected to hoist a light. We struck her just amidships. The force, the size, and weight of our vessel bore her down below the waves; we passed over her, and we hurried on our course. As the crashing wreck was sinking beneath us, I had a glimpse of two or three half-naked wretches rushing from her cabin; they just started from their beds to be swallowed shrieking by the waves. I heard their drowning cry mingling with the wind. The blast that bore it to our ears swept us out of all further hearing. I shall never forget that cry! It was sometime before we could put the ship about, she was under such headway. We returned, as nearly as we could guess, to the place where the smack had anchored. We cruised about for several hours in the dense fog. We fired signal-guns, and listened if we might hear the halloo of any of the survivors; but all was silent—we never saw or heard anything of them more.'"

The expeditions, so many of which have in late years been undertaken in the polar regions, afford ample and thrilling evidence of the dangers attending ocean navigation. The world has read the story of Arctic heroes with amazement. It is sufficient for us here to depict the scene when the celebrated ship "Jeannette" was abandoned among the icebergs of the frozen North. This startling adventure will illustrate the awful hardships and perils which have always attended polar voyages.

The narrative proceeds, as follows: In the early part of June, 1881, the ice around the ship was broken down in immense masses, the whole pack being alive, and had the ship been within one of the fast-closing leads she would have been ground to powder. Embedded in a small island of ice, she was as yet protected from the direct crushing on her sides, but felt a continual hammering and thumping of the ice under her bottom.

The Ship Crushed by Ice.

On the 12th of June, at midnight, in a few moments' time, she was set free by the split of the floe on a line with her keel, and suddenly righting, started all hands from their beds to the deck. By 9 A. M. the ice had commenced coming in on her side; a heavy floe was hauled ahead into a hole where it was supposed the ice coming together would impinge on itself instead of on the ship. The pressure was very heavy, and gave forth a hissing, crunching sound, and at 3.40 P. M. the ice was reported coming through the starboard coal bunkers. At four o'clock she was lying perfectly quiet, but her bows were thrown up so high in the air, that the injury to her forefoot made January 19th, 1880, could be seen.

Melville went on the floe to take her photograph, but on returning to the ship heard the order to prepare to leave the vessel by getting out the chronometers, rifles, ammunition, and other articles to the floe. Lieutenant Chipp was quite sick in bed, but was notified; Captain DeLong "was everywhere, seeing that all things went on smoothly and quietly, without the least haste or consternation among the crew; he came about the deck in the same manner as though we were in no danger whatever, and tried to have the officers and men feel as collected as he was." There was ample time for all persons to get out their personal effects, but to get a barrel of lime-juice, so necessary to prevent scurvy on their march, Seaman Starr waded into the forward store-room at the risk of his life.

When the order was given for all hands to leave the ship at about eleven at night, her water-ways had been broken in, the iron work around the smoke-pipe buckled up, the rivets sheared off, and the smoke-stack left supported only by the guys. Three boats were lowered, the first and the second cutter, and the first whale-boat; and the ship's party of thirty-

three made their camp on the floe in six tents, but within an hour were compelled to move still farther from the edge by the breaking up of the floe in their camp.

At 4 A. M., June 13th, the cry of the watch was heard, "There she goes; hurry up and look, the last sight you will have of the old Jeannette!" While the ice had held together, it had held her broken timbers. When it opened—she sank in thirty-eight fathoms of water, stripping her yards upwards as she passed through the floe. At 3 A. M. her smoke-pipe top was nearly awash; the main topmast first fell by the board to starboard, then the fore topmast, and last of all the mainmast. The ship before sinking had heeled to starboard, and the entire starboard side of the spar deck was submerged, the rail being under water, and the water-line reached to the hatch-coamings before the ship had been abandoned. The next morning, a visit to the place where she was last seen showed nothing more than a signal chest and a cabin-chair with some smaller articles afloat.



THE "JEANNETTE" CRUSHED AND ABANDONED.

Daylight found the party encamped on the ice, about four hundred yards from where the ship went down. The day was spent in arranging the effects and in gaining rest, which was very much needed. Many of

the crew were incapacitated for active work by reason of severe cramps, caused by tin-poisoning from tomato cans. The doctor recommended delay until the sick party should have recovered; but the time was not wasted, and the rest of the crew began the work of dividing the clothing, stowing the sleds and boats.

Fortunate Escape of DeLong and His Men.

There were three boats mounted upon ship-made sleds, each of which consisted of two oak runners, shod with whalebone. The grand total weight of boats, sleds and provisions was about 15,500 pounds. To draw these, the party had a working force, when the retreat commenced, of twenty-two men; and the dogs were employed, with two light sleds, to drag a large amount of stores, that the party had in excess to those permanently stowed upon the larger sleds. Each man had a knapsack stowed away in the boats; each knapsack contained one change of under-clothing, one package of matches, one plug of tobacco, one spare pair of snow-goggles, and one spare pair of moccasins.

On the 17th day of June, the order was given to break camp. The order was obeyed with enthusiasm, and the drag-rope of the first cutter was immediately manned. At the end of the first week the captain found by observation that the drift of the ice had more than neutralized the way covered by his advance, and that in fact he had lost twenty-seven miles by the drift to the northwest in excess to his march to the south. The progress of the party toward the land was very slow, but finally glaciers and water-courses became visible. On the 24th of July the party reached a point not more than two miles distant from the land, but the men were so exhausted that they had to camp. Next morning it was found that they had drifted at least three miles to the southward, and along the east side of the island. On the 27th day of July an island was reached composed of trap-rock and a lava-like soil, and on the 28th a landing was made on the new discovery. Captain DeLong mustered everybody on the island, unfurled a silk flag, took possession of the island in the name of the President of the United States, and called it Bennett Island.

This was one of the best planned and executed expeditions of which we have any record in Arctic exploration, and the escape of the heroes at this time was the condition of their subsequent recovery.

Hunting Arctic Animals.

While dwelling upon the perils of polar expeditions, we must not fail to notice the peril always connected with the capture of such sea-monsters as the whale and walrus. The walrus especially is savage in disposition and has been known to attack its foes with a fury that was appalling. A

navigator in that frigid region, gives a graphic account of his adventures with the great sea-cow, from which we make an interesting extract :

We dredged our way up north to Greenland. It was a stormy spring. We often had to lie-to for a whole week together but we were a jolly



SAVAGE BATTLE WITH WALRUSES.

crew, and well-officered, and we had on board two civilians—Professor kind of chaps I think they were—and they were the life and soul of the whole ship. Whenever we could we took soundings, and hauled up mud and shingle and stuff from the bottom of the dark ocean, even when it was a mile deep and more. But when that mud was washed away, and

the living specimens spread out and arranged on bits of jet-black paper, what wonders we did see, to be sure! Our Scotch doctor called them "ferlies": he called everything wonderful a "ferlie."

But these particular ferlies took the shape of tiny wee shells of all the colors in the rainbow, and funny wee fishes, some not bigger than a pin-point. But, oh! the beauty, the more than loveliness of them! The roughest old son of a gun on board of us held up his hands in admiration when he saw them. We cruised all round Spitzbergen, and all down the edge of the eastern pack ice. We shot bears and foxes innumerable; walruses, narwhals, seals, and even whales fell to our guns.

Loading and Firing to Save the Boat.

Some of those walruses gave us fun, though. I remember once we fell amidst ice positively crowded with them. They seemed but little inclined to budge, either. Again and again we fought our way through them; but the number seemed to increase rather than diminish, till at last our fellows—we were two boats' crews—were thoroughly exhausted, and fain to take to the boats. Was the battle ended then? I thought it was only just beginning, when I saw around us the water alive with fierce tusked heads evidently bent on avenging the slaughter of their comrades.

Our good surgeon was as fond of sport as anyone ever I met, but he confessed that day he had quite enough of it. At one time the peril we were in was very great indeed. Several times the brutes had all but fastened their terrible tusks on the gunwhale of our boat. Had they succeeded, we should have been capsized, and entirely at their mercy.

The surgeon, with his great bone-crushing gun, loaded and fired as fast as fingers could; but still they kept coming. "Ferlies'll never cease," cried the worthy medico, blowing the brains clean out of one which had almost swamped the boat from the stern. Meanwhile it fared but badly with the other boat. The men were fighting with clubs and axes, their ammunition being entirely spent. One poor fellow was pierced through the arm by the tusk of a walrus and fairly dragged into the water, where he sank before he could be rescued.

The ship herself bore down to our assistance, at last, and such a rain of bullets was poured upon the devoted heads of those walruses that they were fain to dive below. The noise of this battle was something terrible; the shrieks of the cow walruses, and the grunting, groaning and bellowing of the bulls, defy all attempts at description.

Loss of the Ship "Essex."

The days of whaling voyages are remarkable for the dangers through which the brave soldiers passed, and the thrilling narratives they have given

SHIPWRECKED SAILORS ATTACKED BY HUNGRY SHARKS.



of their hair-breadth escapes. One of our American seamen, Captain Polard, has furnished us with a full account of the loss of the good ship *Essex*, which we give in his own graphic language :

My first shipwreck was in the open sea, near the equator. The vessel, a South Sea whaler, was called the *Essex*. One day, as we were on the look-out for sperm whales, and had actually struck two, which the boats' crews were following to secure, I perceived a large one—it might be eighty or ninety feet long—rushing with great swiftness through the water, right towards the ship. We hoped that she would turn aside, and dive under, when she perceived such a bulk in her way. But no! the animal came in full force against our stern-post. Had any quarter less firm been struck, the vessel must have burst: as it was, every plank and timber trembled throughout her whole bulk.

The Vessel Rapidly Filling With Water.

The whale shook its head, and sheered off to so considerable a distance, that for some time we had lost sight of her from the starboard quarter; of which we were very glad, hoping that the worst was over. Nearly an hour afterward we saw the same fish—we had no doubt of this, from her size, and the direction in which she came—making again towards us. We were at once aware of our danger, but escape was impossible. She dashed her head this time against the ship's side, and so broke it in that the vessel filled rapidly, and soon became water-logged.

At the second shock, expecting her to go down, we lowered our three boats with the utmost expedition; and all hands, twenty in the whole, got into them; seven, and seven, and six. In a little while, as she did not sink, we ventured on board again; and, by scuttling the deck, were enabled to get some biscuit, beef, water, rum, two sextants, a quadrant, and three compasses. These, together with some rigging, a few muskets, powder, etc., we brought away; and dividing the stores among our three small crews, rigged the boats as well as we could; there being a compass for each, and a sextant for two, and a quadrant for one, but neither sextant nor quadrant for the third.

Then, instead of pushing away for some port, so amazed and bewildered were we, that we continued sitting in our places, gazing upon the ship, as though she had been an object of the tenderest affection. Our eyes could not leave her till, at the end of many hours, she gave a slight reel, then down she sank. No words can tell our feelings. We looked at each other; we looked at the place where she had so lately been afloat; we did not cease to look, till the terrible conviction of our abandoned and perilous situation roused us to exertion, if deliverance were yet possible.

We now consulted about the course which it might be best to take ; westward, to India ; eastward, to South America ; or south westward, to the Society Isles. We knew that we were at no great distance from Tahiti ; but were so ignorant of the state and temper of the inhabitants, that we feared we should be devoured by cannibals if we cast ourselves on their mercy. It was determined, therefore, to make for South America, which we computed to be more than two thousand miles distant. Accordingly we steered eastward, and though for several days harassed with squalls, we contrived to keep together.

Sudden and Alarming Danger.

It was not long before we found that one of the boats had started a plank ; which was no wonder ; for whale-boats are all clinker-built, and very slight ; being made of half-inch plank only, before planing. To remedy this alarming defect, we all turned to, and having emptied the contents of the damaged boat into the two others, we raised her sides as well as we could, and succeeded in restoring the plank at the bottom. Through this accident some of our biscuit had become injured by the salt water. This was equally divided among the several boats' crews. Food and water, meanwhile, with our utmost economy, rapidly failed. Our strength was exhausted, not by abstinence only, but by the labors which we were obliged to employ to keep our little vessels afloat, amid the storms which repeatedly assailed us. One night we were parted in rough weather ; but though the next day we fell in with one of our companion-boats, we never saw or heard any more of the other, which probably perished at sea, being without either sextant or quadrant.

When we were reduced to the last pinch, and out of every thing, having been more than three weeks abroad, we were cheered with the sight of a low, uninhabited island which we reached in hope, but were bitterly disappointed. There being no prospect but that of starvation here, we determined to put to sea again. Three of our comrades, however, chose to remain ; and we pledged ourselves to send a vessel to bring them off, if we ourselves should ever escape to a Christian port. With a very small morsel of biscuit for each, and a little water we again ventured out on the wide ocean. In the course of a few days our provisions were consumed. Two men died. We had no other alternative than to live upon their remains. These we roasted to dryness by means of fires kindled on the ballast-sand at the bottom of the boats.

Casting Lots as to who should be Eaten.

When this supply was spent, what could we do ? We looked at each other with horrid thoughts in our minds, but we held our tongues. I am

sure that we loved each other as brothers all the time; and yet our looks told plainly what must be done. We cast lots, and the fatal one fell on my poor cabin-boy. I started forward instantly, and cried out, "My lad, my lad, if you don't like your lot, I'll shoot the first man that touches you." The poor emaciated boy hesitated a moment or two; then quietly laying his head down upon the gunwale of the boat, he said "I like it as well as any other." He was soon despatched, and nothing of him left. I think then another man died of himself; and him too, we ate.

But I can tell you no more: my head is on fire at the recollection. I hardly know what I say. I forgot to say that we parted company with the second boat before now. After some days of horror and despair, when some were lying down at the bottom of the boat, not able to rise, and scarcely one of us could move a limb, a vessel hove in sight. We were taken on board and treated with extreme kindness. The second lost boat was also picked up at sea, and the survivors saved. A ship afterward sailed in search of our companions on the desolate island, and brought them away.

Captain Pollard closes his dreary narrative with saying, in a tone of despondency never be forgotten by him that heard it: After a time I found my way to the United States, to which I belonged, and got another ship. That, too, I have lost by a second wreck off the Sandwich Islands; and now I am utterly ruined.

Wild Tornadoes and Waterspouts.

We must now speak of those phenomena which are sometimes classed by American meteorologists with whirlwinds, and sometimes among hurricanes, namely, tornadoes. Similar in form to waterspouts, they exceed them greatly in extent, their path often being a mile in width, and their length varying from two to several hundred miles, while they move at the average rate of forty miles an hour. With very few exceptions, all tornadoes move eastward, with a slight deviation toward the north, and sometimes several are seen rushing in parallel courses of from twelve to sixty miles apart. The tornado advances in leaps and springs, passing over the tops of trees, and descending to the ground at intervals.

The current of air in tornadoes is generally directed towards the centre, while in cyclones it has a spiral movement, and in our hemisphere moves in a direction contrary to that of the hands of a clock. In the southern hemisphere, however, it moves with the clock. The cyclone does not blow with regular force, but in violent intermittent gusts and squalls, with an accompaniment of torrents of rain, and mostly thunder

WATERPOUTS IN THE SOUTHERN SEAS.



and lightning. The day is almost as dark as night. The outer storm centre draws in moisture-laden masses of air, while overhead the gloomy storm clouds are dispersed outward with terrific rapidity. The sky is black with heavy clouds for hundreds of miles round the storm centre.

Loss of a Thousand Vessels.

These clouds gather in the upper air, and growing darker as the day advances, slowly sink almost to the earth itself. Then the rain begins in unbroken floods that continue incessantly day and night, as if the dams of a great river were broken through, and its waves poured out in masses on the earth below. The barometer falls lower in proportion to its nearness to the storm centre and to the violence of the storm. The fall of the barometer is the most unfailing sign of the approaching hurricane. A little time generally elapses before the outbreak, but sometimes the storm bursts over the country so suddenly that the barometric warnings are too late. In the terrible typhoon of the 6th of October, 1831, the storm broke at the very moment the barometer fell, so that the ships in the harbor of Mako could take no precautions, and thousands of ships were lost.

In the China seas these sudden outbreaks of typhoons are by no means of rare occurrence. There are, however, certain general signs by which the approach of the destroyer may be heralded. Very fair weather, attended by an unusual transparency of the air, great heat, and calm, with high barometric markings during the south-west monsoon, are very suspicious to the sailor; and if at the same time the sky is seen to assume a strange red coloring, with rugged clouds moving swiftly against the wind, a heavy sea, and a dark bank of cloud in the northeast or south-east quarter, there is no longer room for doubt. In the Bay of Bengal, cyclones are generally formed when there is no strong atmospheric current moving over its waters; the air is usually calm, or only stirred by light, variable winds, the atmospheric pressure being nearly equal along all the coast and only a little rain falling on the eastern and northern coast of the bay, and in Bengal. On the other hand, ships in the centre of the bay, crossing the focus of the cyclone, meet with incessant rains and a temperature lower than that of the surrounding coasts. Finally, a gusty west wind blows from the equator, and when a barometric depression is formed in the centre of the bay, rushes into it, and furnishes the principal aliment of the storm.

Swift Destruction of a British Fleet.

One of the most disastrous of this kind of storms was the tornado remembered chiefly for the destruction of the British fleet under Rodney.

TERRIFIC HURRICANE IN THE TROPICS.

WILLIAMS



About a week before the outbreak of the whirlwind itself, a hurricane in Jamaica destroyed the ships *Scarborough*, *Barbadoes*, *Victor* and *Phoenix*; while the *Princess Royal*, *Henry* and *Sir Austin Hall*, in the harbor of Savanna-la-Mar, were loosed from their anchors, and driven high and dry upon the land, where they were afterwards used as dwelling houses. The centre of the storm advanced across Barbadoes toward Santa Lucia, and its outer limits reached Trinidad and Antigua. In Santa Lucia the hurricane struck the squadron of Admiral Hotham, after which it destroyed a French convoy of two frigates and fifty transport ships at Martinique.

The storm centre then made its way to Porto Rico, where the *Deal Castle* foundered, and advanced, *via* Mona, to Silver Keys, where the *Stirling Castle* went down. The same fate befell the *Thunderer*, above which Walsingham's flag was flying. When the storm had travelled to the twenty-sixth degree of north latitude, it turned sharp round to the north-east, meeting the dismasted ships *Trident*, *Ruby*, *Bristol*, *Hector* and *Grafton*, with Admiral Rowley in command. The hurricane then made its way to the Bermudas, whence the disabled *Berwick* was being despatched to England for repairs.

Houses and People Buried Together.

No less havoc was wrought among the islands of the West Indies. Nine thousand men perished in Martinique: one thousand in St. Pierre alone, where not a house was left standing. The sea rose twenty-five feet high, and 150 houses disappeared from the shore in a moment. In Port Royal, the cathedral, seven churches, and 1,400 houses were thrown down, and 1,600 sick people were buried under the ruins of the hospital, a few only escaping. Almost all the houses built on the shore of Dominique, the royal baking establishment, the magazine, and a part of the barracks, were destroyed. In St. Eustace the storm shattered seven ships against the rocks of Nort Point, and out of nineteen others, which had broken from their moorings and drifted out to sea, only one returned. In Santa Lucia, where 6,000 persons had perished, the most massive buildings were levelled to the ground, cannons were dashed to a distance of a hundred yards, men and animals were lifted into the air and hurled to the ground.

The sea rose to such a terrific height, that it destroyed the fort, and sent a ship crashing against the sailors' hospital. Even the coral reefs covering the bottom of the sea were rent and tossed so that they were later seen above the surface of the water. Out of the six hundred houses at Kingstown, in St. Vincent, only fourteen were left.

BOOK III.

THE SKY.

CHAPTER I.

THE MARVELS OF THE HEAVENS.

The Sun Twelve Hundred Thousand Times as Large as Our Earth—Sublime Scenery of the Midnight Sky—Starry Splendors over Head—Innumerable Worlds in the Firmament—The Boundlessness of Space—Imperial Suns Burning on High—Heavens Piled on Heavens—A Wonderful Journey Through Space—Flying on a Beam of Light—Rich Clusters of Starry Systems—Millions of Worlds—Immeasurable Distances—Swift Motion Everywhere—Astounding Revelations of the Telescope—Lord Rosse's Ten Thousand Eyes—Far-Distant Suns Colored Like the Rainbow—Thomas Moore's Poetical Tribute to the Bright Heavens—Sublimity of Astronomical Science.



FROM the discoveries of astronomy it appears that our earth is but as a point in the immensity of the universe—that there are worlds a thousand times larger, enlightened by the same sun which “rules our day”—that the sun himself is an immense luminous world, whose circumference would enclose more than twelve hundred thousand globes as large as ours—that the earth and its inhabitants are carried forward through the regions of space at the rate of a thousand miles every minute—that motions exist in the great bodies of the universe, the force and rapidity of which astonish and overpower the imagination—and that beyond the sphere of the sun and planets, creation is replenished with millions of luminous globes, scattered over immense regions to which the human mind can assign no boundaries.

Where are the souls to whom the spectacle of starry night is not an eloquent discourse? Where are those who have not been sometimes arrested in the presence of the bright worlds which hover over our heads, and who have not sought for the key of the great enigma of creation? The solitary hours of night are in truth the most beautiful of all our hours, those in which we have the faculty of placing ourselves in intimate communication with great and holy Nature. The orb of day conceals from us the splendors of the firmament; it is during the night that

the panoramas of the sky are open to us. At the hour of midnight, the heavenly vault is strewn with stars, like isles of light in the midst of an ocean extending over our heads.

Orbs of Amazing Brilliancy.

In the midst of darkness our eyes gaze freely on the sky, piercing the deep azure of the apparent vault, above which the stars shine. They traverse the white constellated regions, visiting distant realms of space, where the most brilliant stars lose their brightness by distance; they go beyond this unexplored expanse, and mount still higher, as far as those faint nebulae whose diffused brightness seems to mark the limits of the visible. In this immense passage of sight thought is carried away by its flight and wonders at these distant splendors. It is then that thousands of questions spring up in our minds, and that a thousand points of interrogation rise to our sight. The problem of creation is a great problem! The science of the stars is a sublime science; its mission is to embrace all created things! At the remembrance of these impressions, does it not appear that the man who does not feel any sentiment of admiration before the picture of the starry splendor, is not yet worthy of receiving on his brow the crown of intelligence?

Of all the sciences astronomy is the one which can enlighten us best on our relative value, and make us understand the relation which connects the earth with the rest of creation. Without it, as the history of past centuries testifies, it is impossible for us to know where we are or who we are, or to establish an instructive comparison between the place which we occupy in space and the whole of the universe; without it we should be both ignorant of the actual extent of our country, its nature, and the order to which it belongs. Enclosed in the dark meshes of ignorance, we cannot form the slightest idea of the general arrangement of the world; a thick fog covers the narrow horizon which contains us, and our mind remains incapable of soaring above the daily theatre of life, and of going beyond the narrow sphere traced by the limits of the action of our senses. On the other hand, when the torch of the Science of the Worlds enlightens us, the scene changes, the vapors which darkened the horizon fade away, our mistaken eyes contemplate in the serenity of a pure sky the immense work of the Creator. The earth appears like a globe poised under our steps; thousands of similar globes are rocked in ether; the world enlarges in proportion as the power of our examination increases, and from that time universal creation develops itself before us in reality, establishing both our rank and our relation with the numerous similar worlds which constitute the universe.

If we imagine the terrestrial globe suspended in space, we shall understand that the side turned towards the sun is alone illuminated, whilst the opposite hemisphere remains in shadow, and that this shadow presents the aspect of a cone. Moreover, as the earth turns on itself, all its portions are presented successively to the sun and pass successively into this shadow, and it is this which constitutes the succession of day and night in every country of the world. This simple statement suffices to show that the phenomenon to which we give the name of night belongs really to the earth, and that the heavens and the rest of the universe are independent of it.

This is the reason why, if at any hour of the night we let our minds soar above the terrestrial surface, it will follow that, far from remaining always in the night, we shall again find the sun pouring forth his floods of light through space. If we carry ourselves away as far as one of the planets which like the earth, revolves in the region of space where we are, we shall understand that the night of the earth does not extend to those other worlds, and that the period which with us is consecrated to repose does not exert its influence there. When all beings are buried in the stillness of silent night here—above, the forces of nature continue the exercise of their brilliant functions—the sun shines, life radiates, movement is not suspended, and the reign of light pursues its dominant action in the heavens (as on the opposite hemisphere to ours), at the same hour when sleep overcomes all beings on the hemisphere we inhabit.

Space Has Neither Beginning Nor End.

It is important that we should know, first of all, how to habituate ourselves to this idea of the isolation of the earth in space, and to believe that all the phenomena which we observe upon this globe are peculiar to it and foreign to the rest of the universe. Thousands and thousands of similar globes revolve like it in space. One of the most fatal delusions which it is important we should get rid of at once, is that which presents the earth as the lower half of the universe, and the heavens as its upper half. There is nothing in the world more false than this. The heavens and the earth are not two separate creations, as we have had repeated to us thousands and thousands of times. They are only one. The earth is in the heavens. The heavens are infinite space, indefinite expanse, a void without limits; no frontier circumscribes them, they have neither beginning nor end, neither top nor bottom, right or left; there is an infinity of spaces which succeed each other in every direction. The earth is a little material globe, placed in this space without support of any kind, like a bullet which sustains itself alone in the air, like the little captive

balloons which rise and float in the atmosphere when the thin cord which retains them is cut.

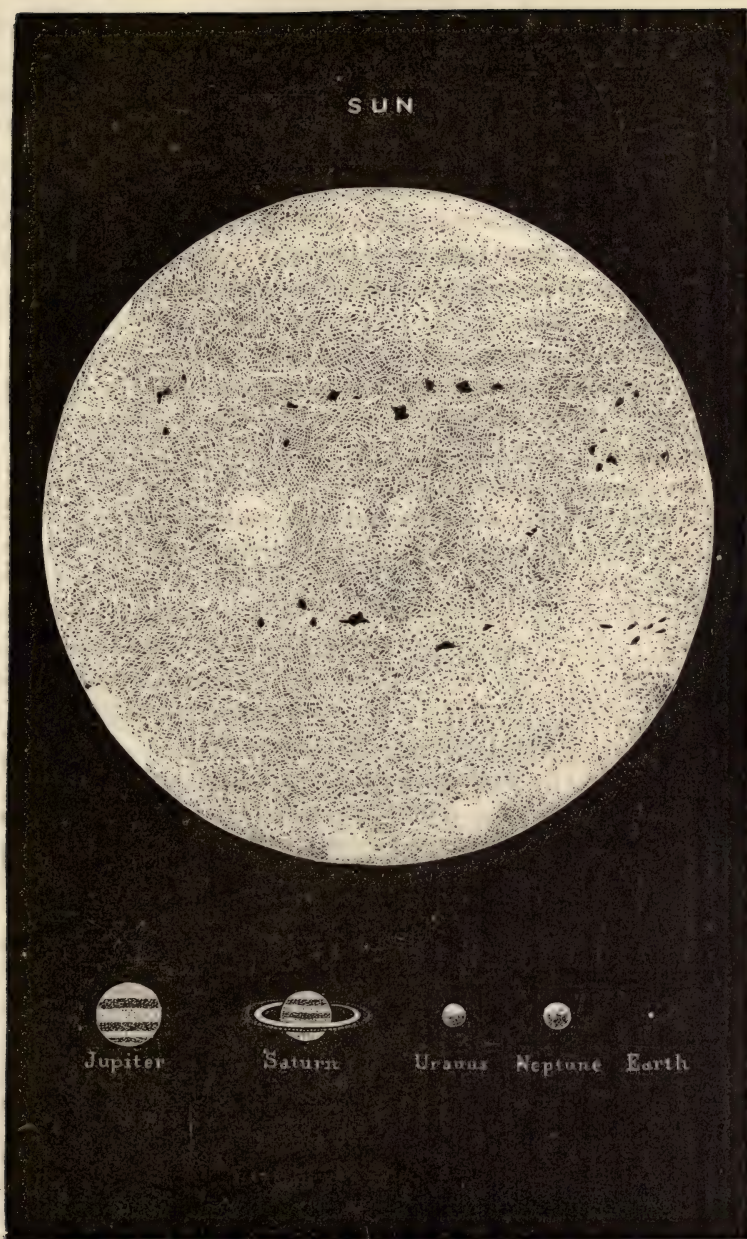
Our World a Star.

The earth is a star in the heavens; it forms part of them; it, in company with a great many other globes similar to it, peoples them; it is isolated in them; and all these other globes also float in space. This conception of the universe is not only very important, but is also a truth which it is absolutely necessary should be well fixed in the mind, otherwise three-quarters of the astronomical discoveries would remain incomprehensible. Here, then, is this first point well understood and thoroughly established in our thoughts. The heavens surround us on every side. In this space the earth is a globe suspended; but the earth is not alone in space. All those stars which sparkle in the heavens are isolated globes, suns shining by their own light; they are very distant from us; but there are stars nearer which resemble much more the one we inhabit, in the sense that they are not suns, but dark earths receiving, like ours, light from our sun. These worlds called planets are grouped in a family; ours is one member of this family. At the centre of this group shines our sun, a source of light which illuminates it, and of heat which warms it. Floating in the bosom of the space which surrounds it on every side, this group is like a fleet of many boats rocked in the ocean of the heavens.

A multitude of suns, surrounded like ours with a family of which they are the foci and the light-givers, float likewise in all parts of the expanse. These suns are the stars with which the fields of heaven are scattered. In spite of the appearance caused by perspective, immense spaces separate all these systems from ours, spaces so great that the highest figures of our great numeration can scarcely number the smallest amongst them. A distance that our figures can scarcely express also separates these stars from each other, extending from depths unto depths.

Heavens Piled on Heavens.

Notwithstanding these prodigious intervals, these suns are in number so considerable that their numeration as yet exceeds all our means; millions joined to millions are inadequate to enumerate the multitude! Let the mind try if it is possible to represent to itself at one time this considerable number of systems and the distances which separate them one from the other! Confused and soon humbled at the aspect of this infinite richness, it will only learn to admire in silence this indescribable wonder. Continually rising on the other side of the heavens, going beyond the distant shores of this ocean without limits, it will endlessly discover fresh new space, and new worlds will reveal themselves to our eager gaze,



RELATIVE SIZES OF THE SUN AND PLANETS.

heavens will succeed to heavens, spheres to spheres; after deserts of expanse will open other deserts, after immensities other immensities; and even when carried away without rest, during centuries, with the rapidity of thought, the soul would continue its flight beyond the most inaccessible limits that imagination could conceive,—there even the infinite of an unexplored expanse would remain still open before it; the infinite of space would oppose itself to the infinite of time; endlessly rivalling, without our ever being able to take away from the other: and the spirit will be arrested, overcome with fatigue, at the entrance of infinite creation, as if it had not advanced a single step in space.

Ye stars! bright legions that, before all time,
 Camped on yon plain of sapphire, what shall tell
 Your burning myriads but the eye of Him
 Who bade through heaven your golden chariots wheel?
 Yet who, earth-born, can see your hosts, nor feel
 Immortal impulses—eternity?
 What wonder if the o'erwrought soul should reel
 With its own weight of thought, and the wild eye
 See fate within your tracks of deepest glory lie?

The immensity of the heavens has been sung on many lyres; but how can the song of man express such a reality? Poets have tried to render it in verse, when one feels the insufficiency of speech to note the immense thoughts which this wonderful contemplation develops in us.

The Illumined Firmaments.

Is there not reason for stating that reality is superior to fiction, even from the point of view of poetical sentiments, and that the contemplation of actual nature encloses a richer and more fruitful source of inspiration than the illusions of the spectacle offered by our senses? Instead of an immense night stretching itself to the azure vaults, instead of a robe worked with gold embroideries, or a veil covered with brilliant ornaments, we are in the bosom of life and universal brightness. Night is but an accident, a happy accident, which enables our looks to extend themselves beyond the limits which the day marks for us; we are like a traveller reclining in the shadow of a hill, who contemplates the illuminated landscape which is unfolded as far as the distant horizon. Instead of the immobility of dead silence, we are present at the spectacle of life on worlds. With the light of truth the arbitrary vaults disappear and heaven opens its depths to us; the infinite of creation is revealed with the infinite of space, and our earth, losing the preponderance which our pretensions had accorded to it, gives way under our feet and disappears in the shade, losing itself in the midst of a multitude of similar little worlds.

There are truths before which human thought feels itself humiliated and perplexed, which it contemplates with fear, and without the power to face them, although it understands their existence and necessity: such are those of the infinity of space and eternity of duration. Impossible to define, for all definition could only darken the first idea which is in us, these truths command and rule us. To try and explain them would be a barren hope; it suffices to keep them before our attention in order that they may reveal to us, at every instant, the immensity of their value. A thousand definitions have been given; we will however neither quote nor recall one of them. But we wish to open space before us and employ ourselves there, in trying to penetrate its depth. The velocity of a cannon-ball from the mouth of the cannon makes swift way, 437 yards per second. But this would be too slow for our journey through space, as our velocity would scarcely be 900 miles an hour. In nature there are movements incomparably more rapid, for instance, the velocity of light. This velocity is 186,000 miles per second. We will place ourselves on a ray of light and be carried away on its rapid course.

A Marvelous Flight Through Space.

Taking the earth as our starting-point, we will go in a straight line to any point of the heavens. We start, and at the end of the first second, we have already traversed 186,000 miles; at the end of the second, 372,000. We continue: ten seconds, a minute, ten minutes have elapsed—111,600,000 miles have been passed. Flying away during an hour, a day, a week, without ever slackening our pace—during whole months, and even a year, the time which we have traversed is already so long that expressed in miles, the numbers exceed our faculty of comprehension, and indicate nothing to our mind; they would be trillions, and millions of millions. But we will not interrupt our flight. Carried on without stopping by this same rapidity of 186,000 miles each second, let us penetrate the expanse in a straight line for whole years, fifty years, even a century.—Where are we? For a long time we have gone beyond the last starry regions which are seen from the earth, the last that the telescope has visited; for a long time we travel in other regions, unknown and unexplored. No mind is capable of following the road passed over; thousands of millions joined to thousands of millions express nothing: at the sight of this prodigious expanse the imagination is arrested, humbled. Well! this is the wonderful point of the problem: we have not advanced a single step in space. We are no nearer a limit than if we had remained in the same place; we should be able again to begin the same course, starting from the point where we are, and add to our voyage a voyage of

the same extent; we should be able to join centuries on centuries in the same itinerary, with the same velocity,—to continue the voyage without end and without rest; we should be able to guide ourselves in any part of space, left, right, forwards, backwards, above, below, in every direction; and when after centuries employed in this giddy course, we should stop ourselves, fascinated or in despair before the immensity eternally open, eternally renewed, we should again understand that our flights had not measured for us the smallest part of space, and that we were not more advanced than at our starting-point. In truth, it is the infinite which surrounds us, as we before expressed it, or the infinite number of worlds. We should be able to float for eternity without ever finding anything before us but an eternally open infinite.

Burning Suns in a Boundless Expanse.

Hence it follows, that all our ideas on space have but a purely relative value. When we say, for instance, to ascend to the sky, to descend under the earth, these expressions are false in themselves, for being situated in the bosom of the infinite, we can neither ascend or descend: there is no above nor below; these words have only an acceptation relative to the terrestrial surface on which we live. The universe must, therefore, be represented as an expanse without limits, without shores, illimited, infinite, in the bosom of which float suns like that which lights us, and earths like that which poises under our steps. Neither dome, nor vaults nor limits, of any kind; void in every direction, and in this infinite void an immense quantity of worlds.

In the bosom of infinite space, the unfathomable extent of which we have tried to comprehend, float rich clusters of stars, each separated by immense intervals. Now the stars are not scattered in all parts of space at hazard: they are grouped as the members of many families. If we compared the ocean of the heavens with the oceans of the earth, we should say that the isles which sprinkle this ocean do not rise separately in all parts of the sea, but that they are united here and there in archipelagoes more or less rich. A Power as ancient as the existence of matter presided at the creation of these isles, each archipelago of which contains a great number; not one amongst them has risen spontaneously in an isolated region; they are all collected in tribes, most of which count their members by millions.

Luminous Clusters of Stars.

These rich groupings of stars have received the name of *nebulæ*. This name was given at the time of the invention of astronomical lenses, when

these starry tribes were distinguished only under a diffused, cloudy aspect, which did not enable the eye to distinguish the composing stars. This appearance not revealing in any way the idea of solar clusters, it was thought that they were only phosphorescent vapors, whirlwinds of luminous substance, or possibly primitive fluids, whose progressive condensation would in the future effect the formation of new stars. They were thought to assist at the creation of distant worlds, and sometimes in remarking their different degrees of luminosity, people thought they could infer their relative ages, as in a forest the age of trees of the same species may be known on approach according to their size or the concentric circles which are formed each year under the bark. Thus the first nebula observed by the aid of the telescope and pointed out as an object of particular nature, the nebula of Andromeda, was considered for three centuries and a half as entirely deprived of stars. Simon Marius of Franconia, who from a musician became an astronomer—very compatible tastes, moreover—describing this oval and whitish appearance, which, more brilliant at the centre, became fainter at the edges, said that it resembled the light of a candle seen at a distance through a sheet of horn.

Starry Archipelagoes in the Upper Deep.

Only a few years ago a Cambridge astronomer counted within the limits of this nebula 1500 little stars, notwithstanding which, the centre still keeps the aspect of a diffused light, in spite of the best instruments. Later, the astronomer Halley thought no more of the star-clusters.

In reality, he states, these spots are nothing more than light coming from an immense space situated in the regions of ether, filled with a diffused and luminous medium by itself. Others, again, imagined that at that spot the brightness of empyrean heaven was seen through an opening in the firmament. Derham said this, the author of astro-theology. But when optical instruments were perfected, this appearance of diffused light was transformed into a brilliant dotting; in proportion as the power of the telescope became more searching, the number of apparent nebulae diminished, and at present many of those which in Galileo's time were regarded as cosmical clouds are resolved into stars. To be just, it must be added that in revealing the stellar composition of the first nebulae, the telescope showed others whose nature has only quite recently been found out; these nebulae remain in an indistinct state, not only on account of their prodigious distance, but because they are composed of vast cloud-masses of glowing gas.

Thus, infinite space must be represented as an immense void in the bosom of which are suspended archipelagoes of stars. These archipela-

goes are themselves of infinite number; the stars which compose them can be counted by millions, and from one to the other the distance is incalculable. They are distributed in space in every direction, following every imaginable course, and invested with every possible form.

At the sight of these globular masses one may ask with Arago, "What is the number of stars contained in some of these clusters?" The astronomer himself replied to his question. It would be impossible to count in detail and accurately the total number of stars of which certain globular nebulae are composed; but one may be able to arrive at limits. In calculating the angular space of the stars situated near the edges, that is to say, in the region where they do not project on each other, and comparing them with the total diameter of the group, it is certain that a nebula, whose apparent superficial extent is scarcely equal to the tenth of that of the lunar disk, does not contain less than 20,000 stars; this is the minimum. The dynamic conditions proper to insure the indefinite preservation of a similar multitude of stars, do not seem easy to imagine, adds the celebrated astronomer. Supposing the system at rest, the stars in time will fall on each other. Giving it a rotary movement round a single axis, shocks will inevitably take place. After all, is it certain that the globular systems of stars must be preserved indefinitely in the state in which we now see them? The examination of changes which have taken place in other systems led to the belief, on the contrary, that there is nothing infinitely stable there, and that movement governs these clusters of suns, as well as it governs each of the stars, and each of the little worlds which revolve round them.

Star Clusters of Curious Shapes.

The most regular nebulae are not the most curious; notwithstanding, the aspect of some of them leaves a certain wonder in the mind. There are star-clusters which, instead of being condensed in an immense globe, are distributed in a crown, presenting the appearance of a circular or oval nebula, but hollow at its centre. One of these is the perforated nebula of Lyra; another is that of Andromeda. In the one, the magnificent telescope of Lord Rosse shows dazzling borders of stars close together, and luminous fringes notching the outer edge; in the other, two suns, symmetrically placed on one side and the other of the ellipse, appear destined to the government of this system in its passage through space. Perforated nebulae are one of the rarest curiosities. That of Lyra is the most celebrated; it was discovered in 1799, at Toulouse, by Arquier, at the time when the comet pointed out by Bode approached the region that it occupied. It is about the apparent size of the disk of Ju-

piter, and forms an ellipse, its two diameters being in the ratio of four to five. The interior of the ring is not dark, but slightly luminous. The hollow space is, however, of a very deep black in the beautiful perforated nebulae of the southern hemisphere. All are probably star-clusters in form of rings.

Ten Thousand Eyes in One.

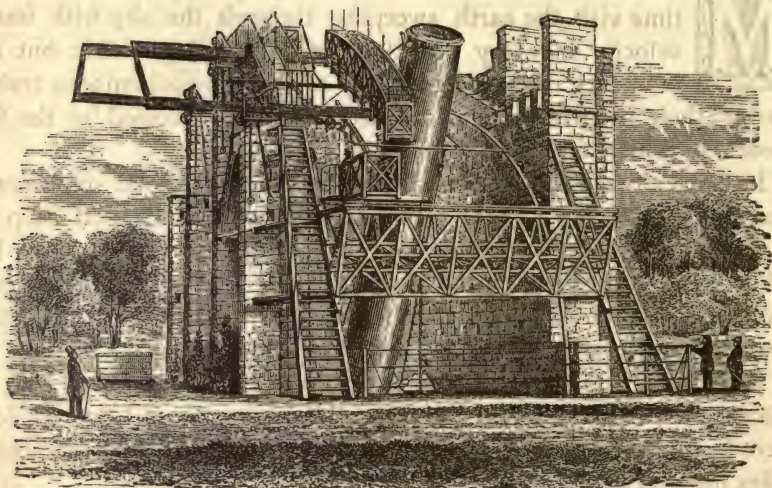
As incidental reference has been made to the telescope, it is appropriate that just here we should glance at this wonderful instrument. The first telescope made, Gallileo's feeble instrument, only magnified objects seven times, and yet with it he discovered the satellites of Jupiter. The first telescope which was constructed of large dimensions was that of Sir William Herschel. He discovered the sixth satellite of Saturn with it. The tube of this instrument being extremely heavy, movement could only be communicated by a very complicated mechanism; a mass of ladders and masts, forming a gigantic pyramid. Its length was nearly forty feet, its diameter nearly five. Euler maintained that in order to see the largest animals in the moon, it would be requisite to have a telescope several hundred feet in length. Hooke thought a glass 10,000 feet long (nearly two miles) would be necessary, and projected the construction of one. The telescope of Lord Rosse has shown that we can obtain this advantage much more easily. It is, says Sir David Brewster, one of our most marvelous combinations of art and science. This magnificent instrument is fixed in the midst of walls which resemble segments of fortifications. The telescope tube is 55 feet in length, and weighs 14,575 pounds avoirdupois. With it one can gauge the immeasurable depths of the heavens. It is thought that by means of this instrument we could easily perceive a monument the size of the pyramids of Egypt, if any existed on the moon. The surface of this planet is there as accurately depicted as a terrestrial landscape

The telescope of Lord Rosse, would certainly not show us a lunar elephant, but a troop of animals like a herd of American buffaloes would be quite visible. Troops marching in order of battle would be clearly perceptible. The observatory at Paris and the capitol at Washington would be very easily seen. We must therefore conclude that if we see nothing of this kind on our satellite, it is because its surface, formerly all flame and volcano, and now all ice, did not or does not contain anything of the kind.

Sir John Herschel explored the stars with instruments which multiplied 6500 times. Lord Rosse fathomed the depths of the heavens with a telescope having a six feet opening, and fifty-five feet in length. Thus by

the potency of this immense optic tube, in which a man could walk with ease, we see several nebulae, which up to the present time had defied all our instruments, resolved into dense swarms of stars. Our means of investigation have given gigantic proportions to the field of science. When the sidereal world was only explored with the naked eye, the catalogue of stars compiled from antiquity only made mention of about a thousand stars. In our days the vault of heaven, seen through a telescope twenty feet long, is found, according to Struve, to contain more than 20,000,000 stars.

But Sir William Herschel pried yet more deeply into the mysteries of the heavens. By means of his telescope, forty feet long, the milky way, this long white train which the Arabs called the Heavenly River, has



LORD ROSSE'S GREAT REFLECTING TELESCOPE.

been resolved into a stellar cloud, in which the English astronomer estimated there were 18,000,000 telescopic stars. And yet can we say that with these overwhelming numbers—these numbers which confound the imagination—we have reached the extreme bounds of science, and that it has traced out the farthest limits of the sidereal universe? Probably not. Other revelations, not less marvelous, may yet astonish our descendants!

Not only do these distant systems, some of them peopled with myriads of suns, take the most varied forms, not only do they present a diversity of aspect greater than it is possible to imagine; but some of them also unfold to the astonished eye which contemplates them varied shades and real colors. One is of a beautiful indigo blue; another is rose-colored at its centre with a white border.

CHAPTER II.

REMARKABLE PHENOMENA IN THE SKY.

Strange Appearances in the Heavens—Fiery Bodies Sweeping Through the Sky—Startling Explosions—An Aërolite Suspended in a Church—Fall of a Great Stone—A Brilliant Meteorite Seen in Connecticut—Balls of Fire Leaping and Whizzing in the Air—A Red Globe Apparently as Large as the Moon—A Shower of Burning Stones—The Great Meteor at Hurworth.

METEORITES are those solid fiery bodies which from time to time visit the earth, sweeping through the sky with immense velocity in every direction, and remaining visible but a few moments; they are generally attended by a luminous train, and during their progress explosions usually occur, followed by the fall of stones, to which the name of aërolites is given.

In November, 1462, at Ensisheim, in Germany, a loud explosion was heard in the air, and a stone seen to fall which buried itself deep in the earth. It weighed 260 pounds, and by the order of the Emperor Maximilian, was suspended in the church at Ensisheim, where it remained until the French revolution. A portion of it is now in the Parisian museum, and another in the Imperial Cabinet at Vienna. In June, 1635, a fiery mass was seen passing over the Veronese territory with such velocity, that the eye could scarcely follow its motions. Loud explosions were heard, and a large stone fell near the Benedictine Convent, about six miles from Verona.

At half past six o'clock, on the morning of the 14th of December, 1807, a meteorite was seen rushing from north to south, over Weston, in the State of Connecticut; its apparent diameter being equal to one-half, or two-thirds, that of the full moon. As it passed behind the clouds, it appeared like the sun through a mist, and shone with a mild and subdued light; but when it shot across the intervals of clear sky, the glowing body flashed and sparkled like a firebrand carried against the wind. Behind it streamed a pale, luminous train, tapering in form, and ten or twelve times as long as its diameter. The meteorite was visible for the space of half a minute, and just as it vanished gave three, distinct bounds. About thirty seconds after its disappearance, three heavy explosions were heard like the reports of a cannon, succeeded by a loud whizzing noise. Directly after the explosions, a person heard a sound resembling that occasioned

by the fall of a heavy body, and upon going from the house perceived a fresh hole in the turf, at the distance of twenty-five feet from the door. At the bottom of the hole, two feet below the surface, an *aërolite* was discovered which weighed nearly thirty-five pounds. Another mass, which was dashed to pieces upon a rock, was judged, from the fragments collected, to have weighed two hundred pounds. Other *aërolites* fell in various parts of the town. The stones, at the time of their descent, were hot and crumbling, but gradually hardened upon exposure to the air.

At Futtypore, in India, in November, 1814, a meteorite was seen, shortly after sunset, shooting swiftly towards the north-west. It appeared as a blaze of light surrounding a red globe of the apparent size of the moon. As it proceeded on its course, loud explosions were heard, resembling the sound of distant artillery, and a stone fell, which, in its descent, emitted sparks like those proceeding from a blacksmith's forge. When first discovered, the *aërolite* was hot and exhaled a strong sulphurous smell. In December, 1836, just before midnight, a meteorite of extraordinary size and brilliancy was seen over the village of Macao, in Brazil, traversing a cloudless sky. It burst with a sharp, loud noise, and a shower of stones fell within a circle of thirty miles. The *aërolites* varied in weight from one pound to eighty, and descended with such force as to break through the roofs of houses, and bury themselves deep in the sand. These extraordinary bodies have been noticed from the earliest ages, and in all parts of the world; and, since attention has been drawn to the subject, scarcely a year now passes without one or more well-attested cases of the fall of *aërolites*.

Immense Size of Meteorites.

We must not confound the magnitude of the meteorite with that of the *aërolite*, for the latter is nothing more than a fragment thrown off from the former and falling to the earth, while the main body sweeps onward in its course. The diameter of the Weston meteorite was computed to be 300 feet, and that of a meteorite observed at Windsor, in August, 1783, was calculated to be no less than 3210 feet, or more than three-fifths of a mile.

Included in natural electrical phenomena at sea is a round ball the size of a full moon, but much brighter and redder, passing slowly from one cloud to another, sometimes succeeded by a terrific explosion of thunder. It seems strange that ships are not oftener struck by lightning, but, although the bolts sometimes fall in quick succession around a ship, they are generally diverted by the superior attraction of the water.

These flaming electric bolts which add so much to the terror and beauty of the ocean are different in cause from the brilliant meteors so often seen on land. Meteors or shooting stars may be occasionally seen on any clear night, but it is about the middle of August and November that the display is most brilliant. Sometimes meteoric showers of several hours' duration are witnessed. Meteors are supposed to be small bodies revolving around the sun, like the planets, in orbits which cross that of the earth. When the earth in its annual revolution arrives sufficiently near, under the influence of its attraction they approach it with great velocity, and on entering the atmosphere of the earth they take fire. In most



THE GREAT METEOR SEEN AT HURWORTH.

cases they are consumed before reaching the earth, and thus disappear in the sky. Sometimes, however, when the mass is large, a loud explosion takes place, and fragments from a few pounds to a ton in weight fall to the ground. In one case a meteoric stone nearly ten tons in weight was found in France. Such wanderers from far distant space or from other worlds are made up of materials similar to those we find in the earth—iron, nickel, quartz, talc, etc. These meteors, when large, are often inexpressibly brilliant. One seen at Hurworth, England, in 1854, lit up the heavens for half an hour with as bright a light as that of the sun, and finally burst with a thunderous explosion heard for many miles.

A multitude of theories have been devised to account for the origin of these remarkable bodies. The idea is completely inadmissible that they are concretions formed within the limits of the atmosphere. The ingredients that enter into their composition have never been discovered in it, and the air has been analyzed at the sea level and on the tops of high mountains. Even supposing that to have been the case, the enormous volume of atmospheric air so charged required to furnish the particles of a mass of several tons, not to say many masses, is, alone, sufficient to refute the notion. They cannot, either, be projectiles from terrestrial volcanoes, because coincident volcanic activity has not been observed, and aerolites descend thousands of miles apart from the nearest volcano; and their substances are discordant with any known volcanic product. Laplace suggested their projection from lunar volcanoes.

It has been calculated that a projectile leaving the lunar surface, where there is no atmospheric resistance, with a velocity of seven thousand seven hundred and seventy-one feet in the first second, would be carried beyond the point where the forces of the earth and moon are equal, would be detached, therefore, from the satellite, and come so far within the sphere of the earth's attraction as necessarily to fall to it. But the enormous number of ignited bodies that have been visible, the shooting stars of all ages, and the periodical meteoric showers that have astonished the moderns, render this hypothesis untenable; for the moon, ere this, would have undergone such a waste as must have sensibly diminished her orb, and almost blotted her from the heavens. Olbers was one of the first to prove the possibility of a projectile reaching us from the moon; but at the same time he deemed the event highly improbable, regarding the satellite as a very peaceable neighbor, not capable now of strong explosions from the want of water and an atmosphere.

Where do Meteors Come From ?

The theory of Chladni will account generally for all the phenomena, be attended with the fewest difficulties, and, with some modifications to meet circumstances not known in his day, it is now widely embraced. He conceived the system to include an immense number of small bodies, either the scattered fragments of a larger mass, or original accumulations of matter, which, circulating round the sun, encounter the earth in its orbit, and are drawn towards it by attraction, become ignited upon entering the atmosphere, in consequence of their velocity, and constitute the shooting stars, aerolites, and meteoric appearances that are observed.

Sir Humphry Davy, in a paper which contains his researches on flame, strongly expresses an opinion that the meteorites are solid bodies moving



A SHOWER OF BRILLIANT METEORS ON THE OCEAN.

in space, and that the heat produced by the compression of the most rarefied air from the velocity of their motion must be sufficient to ignite their mass, so that they are fused on entering the atmosphere. It is estimated that a body moving through our atmosphere with the velocity of one mile in a second would extricate heat equal to thirty thousand degrees of Fahrenheit—a heat more intense than that of the fiercest artificial furnace that ever glowed. The chief modification given to the Chladnian theory has arisen from the observed periodical occurrence of meteoric showers—a brilliant and astonishing exhibition,—to some notices of which we proceed.

The writers of the middle ages report the occurrence of the stars falling from heaven in resplendent showers among the physical appearances of their time. The experience of modern days establishes the substantial truth of such relations, however once rejected as the inventions of men delighting in the marvelous. Conde, in his history of the dominion of the Arabs, states, referring to the month of October, in the year 902 of our era, that on the night of the death of King Ibrahim ben Ahmed, an infinite number of falling stars were seen to spread themselves like rain over the heavens, from right to left; and this year was afterwards called the “year of stars.”

In some Eastern annals of Cairo, it is related that, “In this year (1029 of our era,) in the month Redjeb, (August,) many stars passed, with a great noise and brilliant light;” and in another place the same document states, “In the year 599, on Saturday night, in the last Moharrem, (1202 of our era, and on the 19th of October,) the stars appeared like waves upon the sky, towards the east and west; they flew about like grasshoppers, and were dispersed from left to right; this lasted till daybreak; the people were alarmed.” The researches of the Orientalist, Von Hammer, have brought these singular accounts to light. Theophanes, one of the Byzantine historians, records that in November of the year 472 the sky appeared to be on fire over the city of Constantinople with the coruscations of flying meteors.

“Divers Great Wonders.”

The chronicles of the West agree with those of the East in reporting such phenomena. A remarkable display was observed on the 4th of April, 1095, both in France and England. “The stars seemed,” says one, “falling like a shower of rain from heaven upon the earth;” and in another case, a bystander, having noted the spot where an aerolite fell, “cast water upon it, which was raised in steam with a great noise of boiling.” The chronicle of Rheims describes the appearance, as if all the stars in

heaven were driven, like dust, before the wind. "By the reporte of the common people, in this kynge's time, (William Rufus,)" says Rastel, "divers great wonders were seen; and therefore the king was told by divers of his familiars, that God was not content with his lyvyng, but he was so wilful and proude of minde, that he regarded little their saying." There can be no hesitation now in giving credence to such narrations as these, since similar facts have passed under the notice of the present generation.

The first grand phenomenon of a meteoric shower which attracted attention in modern times was witnessed by the Moravian missionaries at their settlements in Greenland. For several hours the hemisphere presented a magnificent and astonishing spectacle—that of fiery particles, thick as hail, crowding the concave of the sky, as though some magazine of combustion in celestial space were discharging its contents towards the earth. This was observed over a wide extent of territory. Humboldt, then travelling in South America, accompanied by M. Bonpland, thus speaks of it: "Towards the morning of the 13th of November, 1799, we witnessed a most extraordinary scene of shooting meteors. Thousands of bodies and falling stars succeeded each other during four hours. Their direction was very regular from north to south. From the beginning of the phenomenon there was not a space in the firmament equal in extent to three diameters of the moon which was not filled every instant with bodies or falling stars. All the meteors left luminous traces or phosphorescent bands behind them, which lasted seven or eight seconds."

A Spectacle of Awful Grandeur.

An agent of the United States, Mr. Ellicott, at that time at sea between Cape Florida and the West India Islands, was another spectator, and thus describes the scene: "I was called up about three o'clock in the morning, to see the shooting stars, as they are called. The phenomenon was grand and awful. The whole heavens appeared as if illuminated with sky rockets, which disappeared only by the light of the sun after daybreak. The meteors, which at any one instant of time appeared as numerous as the stars, flew in all possible directions, except from the earth, towards which they all inclined more or less; and some of them descended perpendicularly over the vessel we were in, so that I was in constant expectation of their falling on us."

The next exhibition upon a great scale of the falling stars occurred on the 13th of November, 1831, and was seen off the coast of Spain and in the United States. This was followed by another in the ensuing year at exactly the same time. Captain Hammond, then in the Red Sea, off

Mocha, in the ship *Restitution*, gives the following account of it: "From one o'clock in the morning, till after daylight, there was a very unusual phenomenon in the heavens. It appeared like meteors bursting in every direction. The sky at the time was clear, the stars and moon bright, with streaks of light and thin white clouds interspersed in the sky. On landing in the morning I inquired of the Arabs if they had noticed the above. They said they had been observing it most of the night. I asked them if ever the like had appeared before. The oldest of them replied that it had not." The shower was witnessed from the Red Sea westward to the Atlantic, and from Switzerland to the Mauritius.

People Stricken with Terror.

We now come to by far the most splendid display on record; which, as it was the third in successive years, and on the same day of the month as the two preceding, seemed to invest the meteoric showers with a periodical character; and hence originated the title of the November meteors. The chief scene of the exhibition was included within the limits of the longitude of sixty-one degrees in the Atlantic Ocean, and that of one hundred degrees in Central Mexico, and from the North American lakes to the West Indies. Over this wide area an appearance presented itself far surpassing in grandeur the most imposing artificial fireworks. An incessant play of dazzlingly brilliant luminosities was kept up in the heavens for several hours. Some of these were of considerable magnitude and peculiar form.

One of large size remained for some time almost stationary in the zenith, over the Falls of Niagara, emitting streams of light. The wild dash of the waters, as contrasted with the fiery uproar above them, formed a scene of unequalled sublimity. In many districts the mass of the population were terror-stricken, and the more enlightened were awed at contemplating so vivid a picture of the Apocalyptic image—that of the stars of heaven falling to the earth, even as a fig-tree casting her untimely figs, when she is shaken of a mighty wind.

A planter of South Carolina thus describes the effect of the scene upon the ignorant blacks: "I was suddenly awakened by the most distressing cries that ever fell on my ears. Shrieks of horror and cries for mercy I could hear from most of the negroes of three plantations, amounting in all to about six or eight hundred. While earnestly listening for the cause, I heard a faint voice near the door calling my name. I arose, and taking my sword, stood at the door. At this moment, I heard the same voice still beseeching me to rise, and saying, 'O my God, the world is on fire!' I then opened the door, and it is difficult to say which excited me more

—the awfulness of the scene or the distressed cries of the negroes. Upwards of one hundred lay prostrate on the ground, some speechless, and some with the bitterest cries, but with their hands raised, imploring God to save the world and them. The scene was truly awful; for never did rain fall much thicker than the meteors fell towards the earth; east, west, north and south it was the same."

Almost Hit by a Meteor.


A remarkable story is related by Captain Swart, of the Dutch bark, J. P. A. The Captain thinks that his theory, derived from a recent experience, will account for the sudden disappearance of many vessels at sea. He says that March 19, 1887, his ship, while in latitude 37.39 and longitude 57 west, met a heavy storm. At about five o'clock in the afternoon a meteor was observed flying through the air.

It looked like two balls, one very black and the other brightly illuminated. The latter fell, and as it seemed that it would strike the vessel she was hove to under storm sails. The meteor dropped into the sea close along side, making in its flight a tremendous roaring noise. Before reaching the water, the upper atmosphere was darkened, while below and on board everything appeared like a sea of fire. The force of the meteor in striking the water caused heavy breakers, which washed over the vessel, making her roll in a dangerous manner. At the same time the atmosphere became uncomfortably warm and the air was full of sulphur. Immediately afterwards solid lumps of ice fell on the decks, and the decks and rigging became coated with an icy crust, caused by the immense evaporation.

The barometer during the phenomenon oscillated so violently that no reading could be taken. After close examination of the vessel and rigging no damage was found on deck, but on the side where the meteor fell into the water the ship appeared all black and some of the copper sheathing was blistered.

CHAPTER III. A WORLD BURNED OUT AND DEAD.

The Earth Cushioned with Air—The Weight of Every Human Being Seventeen Tons—Our Nearest Planetary Neighbor—Time Required by a Railway Train to Reach the Moon—Lunar Mountains—Moon Torn by Furious Volcanoes—The Fires Extinct—The Surface Cold—Craters and Caverns—Lunar Seas—A Desert World—Eternal Silence—No Air nor Water—No Sky—Young Lady in the Moon—Perpetual Changes—White-Crested Mountains—The Moon's Attractive Features—The Moon a One-Sided Creature—Strange Conjectures as to the Side Turned Away—The First Quarter—Immense Cavities in the Moon's Surface—Measuring Craters—Excitement over First Discoveries—Droll Superstitions—A Satellite Supposed to Rule almost Everything.

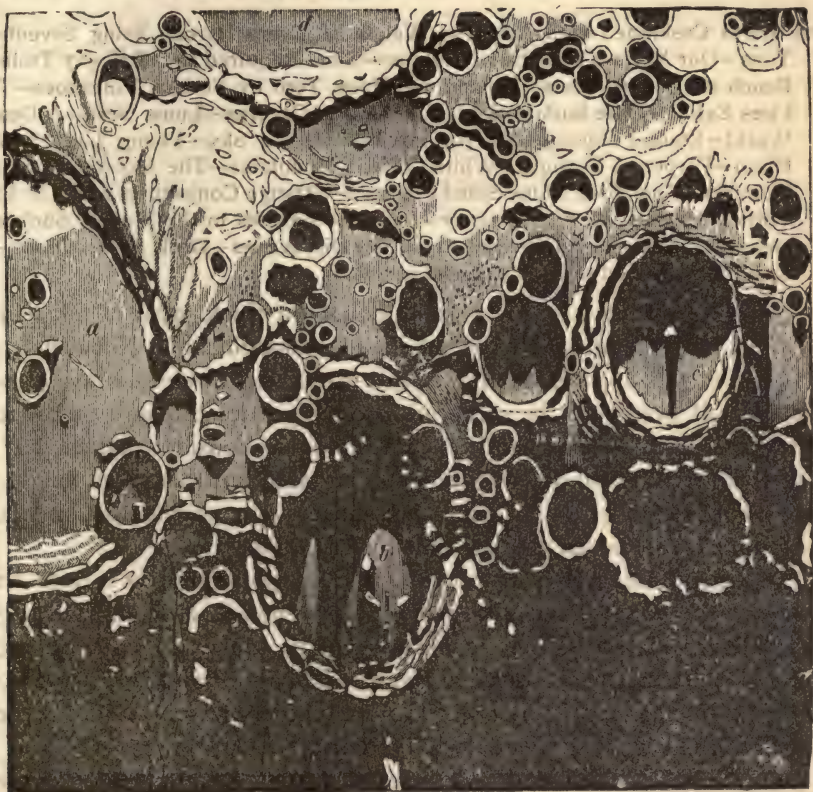
UR planet is entirely enveloped by a thick layer of air, which forms round it the softest cushion imaginable. Notwithstanding its apparent lightness, this atmosphere weighs heavily upon all bodies on the earth, and exerts greater pressure in proportion as they offer a larger surface. Physiologists consider that each of us has a weight of about 35,300 pounds to support, but this great weight is not usually felt, because it is counterbalanced by a counter action equal in all directions, so that the one destroys the other.

The earth is not rich in respect to satellites, possessing as it does only one, which, however, is of dimensions ample enough as compared to it; this is the moon, the faithful companion of its course. Other planets, it is true, like Jupiter and Saturn, are more richly endowed, and have from four to eight satellites; but again there are others which do not possess any, as is the case with Venus and Mercury.

The sole and faithful satellite of the earth, formed by a fragment detached from it, now cold and wan, rolled round us when it began, a red and blazing sphere, vomiting torrents of fire from its whole surface. Whilst gravitation was regulating its form and path, the moon, in the course of thousands of years, exhausted its fires to show us at last its pale and silvery face, the sad luminary of our nights, the splendid nocturnal mirror which reflects to us, pale and cold, the divergent rays of the sun.

Compared to the immeasurable distances of the nebulae and stars, the space which separates us from our satellite is quite insignificant; she is our next-door neighbor and the eye can so clearly discern her form and

peculiarities, that she seems almost to touch us. But this insignificant distance, abstractly considered, is yet vast enough. The distance from the earth to the moon is about 237,000 miles. If it were possible to get there by means of steam, it would require one year and about three hundred and twenty-two days for a locomotive starting from our globe and travelling at a high rate of speed to reach the moon and land its passengers; yet this is but a step compared to the distances of the stars.



VOLCANIC CRATERS ON THE MOON'S SURFACE AT SUNSET.

The moon is in every part roughened with eminences of different shapes, but they only very rarely group themselves into mountain chains comparable to those of our globe. The Alps, Caucasus, and the Apennines represent the principal ones. Certain isolated summits have received the names of celebrated men, but those of past times have been chosen in order not to excite any jealousy; we travel from the Mountain of Aristotle to that of Hipparchus, from that of Ptolemy to that of Copernicus. The astronomers have very properly not forgotten their claims.

The highest lunar mountains attain an altitude which surpasses most terrestrial elevations, a fact which may well astonish us. Generally they do not rise beyond 22,750 feet. But in proportion to the size of the planet, we may say that the mountains in the moon are much loftier than those of the earth. The summits of Mount Dœrfel are 24,700 feet above the valleys which environ it, whilst the crest of Mont Blanc only rises 15,632 feet above the level of the sea.

Most of the mountains of our pale companion are of volcanic origin, and its surface has been so shattered by subterranean fires that in many places the craters are heaped up close beside each other. Probably no star was ever so horribly torn by the fury of volcanoes. These even attain proportions far beyond what is seen in our globe. Some of those lunar craters are four or five leagues in diameter, and the gaping mouth of the volcano of Aristillus, still more prodigious, is ten leagues from one ridge to the other! Our glasses enable us to see these extinct craters in such proportions, that none of their details escape us; whilst, were we on the moon, our telescopes, according to Humboldt, would scarcely enable us to make out terrestrial volcanoes.

Immense Lunar Caverns.

Seen from the earth many lunar volcanoes appear very much depressed, and the edges of their craters resemble so many flattened rings, projecting very little above the plains. Some regions are so riddled with them that their mouths touch. Others surmount lofty summits, and their crenelated ramparts surround enormous excavations, which pierce deep into the mountains below the level of the plains.

Formerly the dark patches which cover part of the moon's surface were considered as representing lunar seas, but at present men are disposed to look upon them as only immense plains. The first astronomers gave them names full of poetry. There was the Sea of Tranquility, the Sea of Clouds, the Sea of Nectar, the Ocean of Tempests, and the Sea of Serenity.

The rocky and shattered soil of our satellite is perfectly bare; not a blade of grass grows there, not a flower opens. Totally deprived of water and air, life is an impossibility. A threefold death would overtake the least animal that happened to alight there; a squirrel would perish of hunger, thirst, and asphyxia! In these cold and horrid realms of the moon, everything is plunged in torpor and silence; the echoes are mute and the breath of a zephyr never plays round the summits of the rugged mountains.

By means of our instruments, which have now been brought to so

great perfection, we can pry into the minutest details of our satellite, and examine them with as much accuracy as if it were some distant view on earth; hence we can to a certain extent make out its geological disposition. The precision of our glasses has been carried to such a pitch, that we could with them easily perceive large buildings, if any existed on the lunar surface; we could even make out troops of animals moving about. It would, it is true, be impossible to perceive one of its inhabitants traversing the valleys of its silver crescent, but if the much spoken of Selenites existed, we should certainly perceive their movements when they were collected into dense masses. According to Humboldt, however, there is only a noiseless, silent desert there.

Sir Walter Scott gives us in one of his fine poetical outbursts this apostrophe to the lunar world:

Hail to thy cold and clouded beam,
Pale pilgrim of the troubled sky!
Hail, though the mists that o'er the stream
Lend to thy brow their sullen dye!
How should thy pure and peaceful eye
Untroubled view our scenes below?
Or how a tearless beam supply!
To light a world of war and woe?

There is a great contrast, not only apparent but real, between the serene tranquility of the lunar disk and the great movements which are ceaselessly carried on on the surface of our world. On approaching the moon nothing is seen of the physical causes which make the earth a vast laboratory wherein a thousand elements contend or unite with each other. There are none of those tumultuous tempests which sometimes sweep over our undulated plains; none of those hurricanes which descend in waterspouts to be swallowed up in the depth of the sea; no wind blows, no cloud rises to the heavens. There white trains of cloudy vapors are not seen, nor those laden masses with heavy cohorts; the rain never falls; and neither snow, nor hail, nor any of the meteorological phenomena are manifested there.

But, on the other hand, the magnificent tints which color our sky at sunrise and twilight, the radiation of the heated atmosphere, are never seen there; if winds and tempests never blow, neither is there the balmy breeze which descends upon our coasts. In this kingdom of sovereign immobility, the lightest zephyr never comes to caress the hill-tops; the sky remains eternally asleep in a calm incomparably more complete than that of our hottest days when not a leaf moves in the air. This is because on the surface of this strange world there is no atmosphere. From this privation results a state of things difficult to realize.

In the first place, the absence of air implies also the absence of water and every liquid, for water and liquids can only exist under atmospheric pressure: if this pressure is taken away they evaporate and their beds are dried up. Thus, for instance, if you place a vessel filled with water under the receiver of an air-pump, and then, by pumping out the air which is in the receiver, you make a vacuum, you will soon see the water boil, even when the place where the experiment is made is frozen with the most intense cold. The boiling disengages vapors, and, finally, the water is evaporated. Now let us suppose, that, at a certain period of its past existence the moon had, like the earth, seas and rivers, and that by the aid of any apparatus, its seas and rivers were made to boil and to fall into vapor again; by continuing this operation long enough the moon would be made completely dry: this is precisely what has happened.

Since the distant period of its formation in a fluid state, it has lost all its liquids and vapors, and now a linnet would die of thirst in the midst of the seas of the moon. These seas do not contain a drop of water. These, it will be said, are singular seas. And, indeed, no one will hold that their title is logical. But, we have seen that they were named at a time when people did not know the lunar surface sufficiently well to guess that it existed without air and water. From the absence of air follows another very curious fact—the absence of sky. An immensity without depth is traversed by the sight, and in the day as in the night are seen the stars, planets, comets, and all the bodies of our universe. The sun passes among them without extinguishing them, as it does to us. Not only does the moon not possess this perpetual diversity which the movements of the air produce on our world, but it has not the azure vault which covers the earth with such a magnificent dome; space is a black and a perpetually black abyss.

Awful Silence and Desolation.

Whilst on high there reigns darkness, below there is silence. Not the least sound is ever heard; the sigh of the wind in the woods, the rustling of foliage, the song of the morning lark, or the sweet warbling of the nightingale never awakens the eternally dumb echoes of this world. No voice, no speech has ever disturbed the intense solitude with which it is overspread. Unchangeable silence reigns there in sovereignty. Tall perpendicular mountains divide its surface. Here and there are seen worn-out craters rising towards the sky, white rocks heaped up like the ruins of some long-passed revolution, crevasses crossing the surface as in lands dried by the burning rays of long summer days. That which renders the spectacle more strange is that the absence of vapors causes the absence

of perspective as well as the absence of all tints, and we see only white or black according as the object is in the sun's light or in shadow, the ob-

PART OF THE MOON'S CRESCENT DURING THE FIRST QUARTER.



jects succeeding each other as far as the horizon without losing brightness or contour. The moon is such a singular world that its mountains may be measured as well by depth as height. This paradox, rather difficult

to understand, arises from the fact that the mountains of the moon are not like those of the earth, but are hollow. When we arrive at the top there is a ring, the white, rugged and sterile mountains, and lofty and deserted craters. These solitary and dried-up landscapes remind us of what Fontenelle said regarding the changes at work on the surface of our satellite, caused, not by the movements of life, like those which regulate terrestrial nature, but by the simple falling down of lands. "Everything is in perpetual motion," he says. "Even including a certain young lady, who was seen in the moon with a telescope about forty years ago, everything has considerably aged. She had a pretty good face, but her cheeks are now sunken, her nose is lengthened, her forehead and chin are now prominent to such an extent, that all her charms have vanished, and I fear for her days."

"What are you relating to me now?" interrupted the Marchioness.

"This is no jest," returned the author. "Astronomers perceived in the moon a particular figure which had the aspect of a woman's head, which came forth from between the rocks, and then occurred some changes in this region. Some pieces of mountain fell, and disclosed three points which could only serve to compose a forehead, a nose, and an old woman's chin." We do not know whether the face, of which the ingenious writer speaks, existed anywhere but in his imagination; but changes, even caused by simple fallings, are extremely rare, if even they are still produced. For a hundred years, for instance, during which period a day has not elapsed in which the moon has been visible, without it being observed by the telescope, the slightest movement has never been noticed.

A Lonely and Deserted Planet.

At the commencement of the century, it is true, people fancied they observed active volcanoes, but they have since discovered that very probably what were then taken for volcanoes were nothing more than the white crests of certain mountains, their form or their structure being more favorably adapted to reflect light. Thus the orb of night remains dumb and silent, revolving in the heavens like a deserted planet. Why this sad and solitary fate? Why deprived of movement and life? This is the question asked by the poet Shelley:

Art thou pale for weariness,
Of climbing heaven and gazing on the earth,
Wandering companionless
Among the stars that have a different birth,
And ever changing, like a joyless eye
That finds no object worth its constancy?

Now that we have pointed out how the moon is an inhospitable world, poor and destitute of nature's gifts, it is necessary to retrace our steps, and show it to you as a magnificent world, worthy of admiration and esteem. We do not wish to contradict the foregoing words; but in order not to leave a bad impression with regard to our faithful friend, we wish to remind you that nature, even when it appears to disgrace some of its works from some points of view, favors them with very desirable riches when regarded under other aspects.

To an astronomer, the moon would be a magnificent observatory. In the daytime he could observe the stars at noon, and thus discover, without trouble, that they reside eternally in the heavens. With us, on the contrary, among the ancients, were a great number who imagined that they were lighted up in the evening and extinguished in the morning. If, then, people make astronomical observations on the moon, the sun is not a tyrant who governs the heavens absolutely; it allows the stars to be enthroned peaceably with it in space; and studies commenced during the night can be carried on without difficulty during the day until the following night. On our satellite the nights are fifteen times twenty-four hours long, and the days are of the same length; but there is an essential difference to remark between the nights of the lunar hemisphere, which faces us, and those of the hemisphere which we do not see.

Strange Old Fancies About the Moon.

You must have noticed that the moon always presents the same side to us. From the beginning of the world it has never shown but this side. We read in Plutarch, who wrote nearly two thousand years ago, a thousand conjectures relative to the side of the moon always turned toward us. Some said it was a large mirror, well polished and excellent, which sent back from afar the image of the earth; the dark portions represented the oceans and seas, while the bright portions represented the continents. Others believed that the spots were forests, where some placed the hunts of Diana, and that the most brilliant parts were the plains. Others, again, saw in it a very light, celestial earth; they stated that its inhabitants must pity the earth which is below them, and which is only a mass of mud. Others, again, and their singular opinion was widely spread, added that the beings who peopled it were fifteen times larger than those of our earth, and by the side of the lunar trees our oaks would only be small bushes. All this to explain the nature of the lunar face eternally turned towards us.

Now, if we never see but one side of the moon, it follows that there is only one side of this body which sees us; so that half of the moon has a

moon—namely, our earth, and the other half is deprived of one. If there are any inhabitants on the hemisphere turned from us, they do not guess that the moon is only a body placed for illumination of our nights, and they must be greatly astonished when the narratives of travellers relate to them the existence of our earth in the heavens. If the travellers there resemble those here, what tales must they spread with regard to us? But, also, how useful must the earth be to the lunar nights, and how beautiful we are—from afar!

Fancy to yourself fourteen moons like that which gives us light, or



THE EARTH AS SEEN FROM THE MOON.

more properly speaking, a moon with fourteen times the extent of surface, and you will have an idea of the earth as seen from the moon. Sometimes it only presents a fringed crescent, a few days after the new earth; sometimes it presents the first quarter; sometimes it shines out with its full disk, spreading its silvered light in floods. The most fortunate thing is, that it begins to shine precisely in the evening, that its brightest light, its full disk, is precisely at midnight, and that it fades away in the morning at the time when it is no longer required. And it is known that from the evening to the morning is fifteen times twenty-four hours with our neighbors the Selenites. How much more reasonable are these inhabitants than we are in believing that the moon was created and placed in the

world expressly for them, and that we are only their very humble servants! The lunar caverns form a very peculiar and prominent feature of the



SINGULAR ASPECT OF THE MOON'S SURFACE.

moon's surface, and are to be seen in almost every region, but are most numerous in the south-west part of the moon. Nearly a hundred of

them, great and small, may be distinguished in that quarter. They are nearly of a circular shape, and appear like a very shallow egg cup. The smaller cavities appear within almost like a hollow cone, with the sides tapering towards the centre; but the larger ones have, for the most part, flat bottoms, from the centre of which there frequently rises a small, steep conical hill, which gives them a resemblance to the ridges and mountains already described.

In some instances their margins are level with the general surface of the moon; but in most cases they are encircled with a high ridge of mountains marked with lofty peaks. Some of the larger of these cavities contain smaller cavities of the same kind and form, particularly in their sides. The mountainous ridges which surround these cavities reflect the greatest quantity of light; and hence that region of the moon in which they abound appears brighter than any other. From their lying in every possible direction, they appear, at and near the time of full moon, like a number of brilliant streaks or radiations. These radiations appear to converge towards a large brilliant spot surrounded by a faint shade, near the lower part of the moon, which is known by the name of Tycho, and which every one who views the full moon even with a common telescope, may easily distinguish.

Caverns Miles in Depth.

In regard to their dimensions, they are of all sizes, from three miles to fifty miles in diameter at the top; and their depth below the general level of the lunar surface varies from one third of a mile to three miles and a half. Twelve of these cavities, as measured by Schroeter, were found to be above two miles in perpendicular depth. These cavities constitute a peculiar feature in the scenery of the moon, and in her physical constitution, which bears scarcely any analogy to what we observe in the physical arrangements of our globe.

It is a curious fact that the surface of the lunar hemisphere was known before that of our own earth, and the heights of all its mountains were measured before the same thing was done for our own. The volcano of Aristillus in particular was one of the first and best known. Lecouturier, the author of a very good map of the moon, gave a long description of it, and this description may be applied to most of the lunar mountains. It is composed of a crater about twenty-four miles across, from the centre of which rise two cones, the highest of which attains nearly 984 yards; the whole is surrounded by a circular rampart.

When the bottom of the crater is examined with a powerful telescope, and under favorable circumstances, numerous rough portions are noticed

which seem to indicate hardened lava and blocks of rock heaped together. From this mountain, taken as a centre, start five or six lines and rocky ramifications directed towards the east and south. These ramifications give rise to the radiation of Aristillus. They are surmounted by an enormous quantity of peaks or basaltic columns which rise from their summits, and make them resemble from afar the multitude of bell towers that are seen on some Gothic cathedrals. Aristillus presents the general aspect of most of the mountains of our satellite.

Thus the moon would appear very inhospitable to us. The sense of speech, like the sense of hearing, would be lost, and, consequently, would not exist. To the privation of these two senses, perhaps, must be added an inferiority in the pleasures which sight gives to us, seeing that wherever the eye would be directed, it would only meet with a scene of comparative desolation.

Of all heavenly bodies, this is the one men understood the first and best. Since the invention of the first telescopes, scarcely 250 years ago—those primitive instruments whose power was far from attaining the stellar regions, and could only be effectually applied to this nearest body—astronomers, astrologers, alchemists, and all those who were occupied with science, felt themselves urged by a desire to penetrate into the mysteries of this celestial land. The first observations of Galileo did not make less noise than the discovery of America; many saw in them another discovery of a new world much more interesting than America, as it was beyond the earth. It is one of the most curious episodes in history, that of the prodigious excitement which was caused by the unveiling of the moon.

Superstitions About the Moon.

Imagination at once took flight to the new celestial world. Very curious voyages to the moon then appeared, astonishing excursions, unpardonable fancies, and serious studies were soon eclipsed by the visions of impatient minds. Notwithstanding all this, astronomical discovery rapidly advanced. Encouraged by the first revelations of the telescope, astronomers undertook the complete study of the lunar surface. The aspect of the moon to the naked eye, that rude face that was seen with little good will on its pale disk, was transformed in the field of the telescope, and at first very bright portions and very dark portions were alone distinguished.

Examining it more attentively, and increasing the magnifying power of the instrument, it was discovered that the aspect of the details changed according as the sun was on one side or the other of the moon; that on

the days when the sun was at the left of the bright portion, dark lines were seen to the right, whilst in the opposite case, the dark shadow appeared to the left. It was then easy to prove that the bright portions were mountains, that the dark portions which were close to them were valleys, or low countries; and lastly, that the large plains were lands which reflected the solar light less perfectly.

It is doubtless this proximity which has caused the great reputation of the lunar orb amongst us. No celestial body, except the sun, has ever had a similar influence. The whole world, it was supposed, was accessible to the lunar influences, men, animals, plants, minerals. The astrological opinions with regard to this body were most singular. We must quote some; they are really too curious to be passed over in silence. Let us choose one or two good astrologers, learned on the moon, and let us question them.

Old Ideas of What the Moon Did.

Cornelius Agrippa, a famous geomancer, thus expresses himself: The moon is called Phœbe, Diana, Lucinus, Proserpine, Hecate, who governs the months, half-formed; who illuminates the nights, wandering, in silence, with two horns; queen of divinities, queen of heaven, who rules over all the elements, to whom respond the stars, to whom return the seasons, and whom the elements obey; at whose direction the thunders sound, the seeds germinate, the germs increase; the primordial mother of fruits, heart of Phœbus, shining and brilliant, carrying light from one planet to another, illuminating by her light all the divinities, stopping various intercourses with the stars, distributing the light rendered uncertain on account of meetings with the sun; queen of beauty, mistress of shores and winds, giver of riches, nurse of men, governor of all states good and unhappy; protecting men by sea and land, moderating the reverses of fortune; dispensing with destiny, nourishing all which comes out of the earth, arresting the insults of phantoms, holding the cloisters of the earth closed, the heights of heaven luminous, the currents of the sea salutary, and ruling at will the deplorable silence of the lower regions, governing the world, treading Tartarus under foot; of whom the majesty causes the birds which fly in the sky, savage beasts in the mountains, the serpents hidden under the earth, and the fish in the sea, to tremble.

According to Eteilla, the moon governs comedians, butchers, tallow and wax chandlers, ropemakers, lemonade-vendors, publicans, playwrights of all kinds, masters of great works, menageries of animals; and, on the other hand, professional gamblers, spies, sharpers, cheats, bankrupts, false money-coiners, and mad-houses; that is to say, the

moon rules over all those whose business it is to work during the night until sun-rising, or to sell provisions for the night; and it also rules over all which people would be ashamed to commit in full day, in sight of those who have manners. Thus each reader, on reading, may easily find out of what denomination he is.

Rainbow at Night.

The iris lunaris, or lunar rainbow, is a much rarer object than the solar one. It frequently consists of a uniformly white arch, but it has often been seen tinted, the colors differing only in intensity from those caused by the direct solar illuminations. Aristotle states that he was the first observer of this interesting spectacle, and that he only saw two in the course of fifty years; but it must have been repeatedly witnessed, without a record having been made of the fact. Thoresby relates an account, received from a friend, of an observation of the bow fixed by the moon in the clouds. She had passed the full about twenty-four hours. The evening had been rainy, but the clouds had dispersed, and the moon was shining very clearly. This lunar iris was more remarkable than that observed by Dr. Plot, of which there is an account in his History of Oxford, that being only of a white color; but this had all the hues of the solar rainbow, beautiful and distinct, but fainter.

Bucke remarks upon having had the good fortune to witness several, two of which were perhaps as fine as were ever witnessed in any country. The first formed an arch over the vale of Usk. The moon hung over the Blorenges; a dark cloud was suspended over Myarth; the river murmured over beds of stones, and a bow, illumined by the moon, stretched from one side of the vale to another. The second was seen from the castle overlooking the Bay of Carmarthen, forming a regular semicircle over the River Towy. It was in a moment of vicissitude; and the fancy of the observer willingly reverted to the various soothing associations under which sacred authority unfolds the emblem and sign of a merciful covenant.

CHAPTER IV.

MAGNIFICENT AURORAL DISPLAYS.

Most Striking of Optical Splendors—Auroral Arc—Streams of Light Shooting Upward—Trembling Gleams and Flashes—"The Merry Dancers"—Lights of Rainbow Colors—What Parry and Franklin Saw—The Heavens in Gay Attire—Lieutenant Chappell's Auroral Umbrella—Arch of Silvery Light—The Canopy Glowing with Splendid Scenery—Polar Night—Six Months without a Sun—Animals Dying of Gloom—Dazzling Standards Unfurled—Magnetism—Fiery Tempests in the Sun—Magnetic Stones on Earth—Outbreak of Auroral Magnificence—Sir John Herschel's Conclusions—The Jerking Needle—Reference by Aristotle—Northern Lights more Common than formerly in the Northern Zones.



AMONG the remarkable phenomena of the sky must be placed the bright aurora. Of all optical phenomena, the aurora borealis, or the northern daybreak, is one of the most striking, especially in the regions where its full glory is revealed.

What fills with dazzling beams the illumined air?
What wakes the flames that light the firmament?
The lightnings flash: there is bright splendor there,
And earth and heaven with fiery sheets are blest;
The winter's night now gleams with brighter, lovelier ray,
Than ever yet adorned the golden summer's day.

The appearances exhibited by the aurora are so various and wonderful. A cloud, or haze, is commonly seen in the northern region of the heavens, but often bearing towards the east or west, assuming the form of an arc, seldom attaining a greater altitude than forty degrees, but varying in extent from five to one hundred degrees. The upper edge of the cloud is luminous, sometimes brilliant and irregular. The lower part is frequently dark and thick, with the clear sky appearing between it and the horizon. Streams of light shoot up in columnar forms from the upper part of the cloud, now extending but a few degrees, then as far as the zenith, and even beyond it.

Instances occur in which the whole hemisphere is covered with these coruscations; but the brilliancy is the greatest, and the light the strongest, in the north, near the main body of the meteor. The streamers have in general a tremulous motion, and when close together present the appearance of waves, or sheets of light, following each other in rapid succession. But no rule obtains with reference to these streaks, which have acquired the name of "the merry dancers," from their volatility,

becoming more quick in their motions in stormy weather, as if sympathizing with the wildness of the blast. Such is the extraordinary aspect they present, that it is not surprising the rude Indians should gaze upon them as the spirits of their fathers roaming through the land of souls. They are variously white, pale red, or of a deep blood color, and sometimes the appearance of the whole rainbow as to hue is presented.

Lights of Various Colors.

When several streamers emerging from different points unite at the zenith, a small and dense meteor is formed, which seems to burn with greater violence than the separate parts, and glows with a green, blue, or purple light. The display is over sometimes in a few minutes, or continues for hours, or through the whole night, and appears for several nights in succession. Captain Beechey remarked a sudden illumination to occur at one extremity of the auroral arch, the light passing along the belt with a tremulous, hesitating movement towards the opposite end, exhibiting the colors of the rainbow; and as an illustration of this appearance, he refers to that presented by the rays of some molluscous animals in motion.

Captain Parry notices the same effect as a common one with the aurora, and compares it, as far as its motion is concerned, to a person holding a long ribbon by one end, and giving it an undulatory movement through its whole length, though its general position remains the same. Captain Sabine likewise speaks of the arch being bent into convolutions, resembling those of a snake in motion. Both Parry, Franklin, and Beechey agree in the observation that no streamers were ever noticed shooting downwards from the arch.

The preceding statement refers to aurora in high northern latitudes, where the full magnificence of the phenomenon is displayed. It forms a fine compensation for the long and dreary night to which these regions are subject, the gay and varying aspect of the heavens contrasting refreshingly with the repelling and monotonous appearance of the earth. We have already stated that the direction in which the aurora generally makes its first appearance, or the quarter in which the arch formed by this meteor is usually seen, is to the northward. But this does not hold good of very high latitudes, for by the expeditions which have wintered in the ice, it was almost always seen to the southward; while, by Captain Beechey, in the "Blossom," in Kotzerne Sound, two hundred and fifty miles to the southward of the ice, it was always observed in a northern direction. It would appear, therefore, from this fact, that the margin of the region of packed ice is most favorable to the production of the meteor.

The reports of the Greenland ships confirm this idea: for, according to their concurrent testimony, the meteor display has a more brilliant aspect to vessels passing near the situation of the compact ice, than to others entered far within it. Instances, however, are not wanting of the aurora appearing to the south of the zenith in comparatively low latitudes. Lieutenant Chappell, in his voyage to Hudson's Bay, speaks of its forming in the zenith, in a shape resembling that of an umbrella, pouring down streams of light from all parts of its periphery, which fell vertically over the hemisphere in every direction. As we retire from the pole, the phenomenon becomes a rarer occurrence, and is less perfectly and distinctly developed. In September, 1828, it was observed in England as a vast arch of silvery light, extending over nearly the whole of the heavens, transient gleams of light separating from the main body of the luminosity.

Dalton has furnished the following account of an aurora, as observed by him: Attention was first excited by a remarkably red appearance of the clouds to the south, which afforded sufficient light to read by at eight o'clock in the evening, though there was no moon nor light in the north. From half past nine to ten there was a large, luminous, horizontal arch to the southward, and several faint concentric arches northward. It was particularly noticed that all the arches seemed exactly bisected by the plain of the magnetic meridian. At half past ten o'clock streamers appeared, very low in the south-east, running to and fro from west to east. They increased in number, and began to approach the zenith, apparently with an accelerated velocity, when all on a sudden the whole hemisphere was covered with them, and exhibited such an appearance as surpasses all description.

A Spectacle Sublimely Brilliant.

The intensity of the light, and prodigious number and volatility of the beams, the grand intermixture of all the prismatic colors in their utmost splendor, variegating the glowing canopy with the most luxuriant and enchanting scenery, afforded an awful, but at the same time the most pleasing and sublime spectacle in nature. Every one gazed with astonishment, but the uncommon grandeur of the scene only lasted one minute. The variety of colors disappeared, and the beams lost their lateral motion, and were converted into the flashing radiations.

The great distinction between the polar countries and the other regions of the globe, is their long day and long night. Describing an immense spiral around the horizon, the sun gradually mounts to the highest point of his course; then, in the same manner, it returns towards the horizon, and bids farewell to earth, slowly dying away in a gloomy and ghastly twilight. And, for six months, the Arctic wildernesses know it not.

When the navigator, says Captain Parry, finds himself buried for the first time in the silent shadows of the polar night, he cannot conquer an involuntary emotion of dread; he feels transported out of the sphere of ordinary existence. These deadly and sombre deserts seem like those uncreated voids which Milton has placed between the realms of life and death. The very animals are affected by the melancholy which veils the face of nature. Under the influence of the almost perpetual gloominess Dr. Kane's Newfoundland dogs went mad, and died.

Six Months' Night.

But if the sun for six months of the year deprives the circumpolar countries of the splendor of its fires, an imposing phenomenon frequently illuminates the long nights with dazzling radiance, as if nature sought to compensate for the absence of the orb of day by the most impressive of all her optical wonders. The polar nights are nearly always lighted up by the gorgeous lustre of the aurora; called borealis or australis, according to the poles at which it is produced. Shafts and rays of light shoot upwards to the zenith. These luminous sheaves pass through all the colors of the rainbow; from violet and sapphire to green and purple-red. Sometimes the columns of light issue from the resplendent arch mixed with blackish rays; sometimes they rise simultaneously at different points of the horizon, and unite to form a sea of flame pervaded by rapid undulations. On other occasions, fiery dazzling standards are unfurled to float lightly in the air. A kind of canopy of soft and tranquil light, which is known as the corona, announces the close of the phenomenon. Thereupon the luminous shafts begin to wane in splendor, the richly colored arcs dissolve, die out, and soon of all the magnificent spectacle nothing remains but a whitish cloudy haze.

The arch of the aurora is only part of a ring of light, which is elevated considerably above the surface of our globe, and whose centre is situated in the vicinity of the pole. It is easy, then, to account for the different aspects it presents to observers placed at different angles to it. A person some degrees south of the ring would necessarily see only a very small arc of it towards the north, from the interposition of the earth between him and the observer; if he stood nearer the north, the arc would appear larger and higher; if immediately below it, he would see it apparently traversing the zenith; or if within the ring and still further north, he would suppose it to culminate in the south. It is supposed that the centre of the ring corresponds with the magnetic north point, in the island of Boothia Felix.

Flags and Streamers of Light Fluttering in the Sky.

The phenomenon generally lasts several hours, and is frequently diversified by peculiar features; so that sometimes it seems to present the hem-

ispherical segment of a gigantic wheel ; sometimes it waves and droops like a rich tapestry of colored light, in a thousand prismatic folds ; and, at other times, it may be compared to a succession of resplendent banners, or streamers, waving in the dark and intense sky.

The arch varies in elevation, but is seldom found more than ninety miles above the terrestrial surface. Its diameter must be enormous, for it has been known to extend from Italy to the polar regions, and has been simultaneously visible in Sardinia, Connecticut, and New Orleans.

According to some authorities, the phenomenon is accompanied by noises resembling the discharge of fireworks, or the crackling of silk when one piece is rolled over another ; but this statement is not confirmed by the experience of our ablest Arctic voyagers.

Of the magneto-electric origin of the aurora no doubt can be entertained. When it occurs, the magnetic needle is invariably affected, the perturbation being greatest at the climax of the auroral brilliancy. The vortex of the arch is almost always in or near the magnetic meridian. The lights would seem to result from a discharge at or around the magnetic poles of electricity which has gradually accumulated at these opposite points.

Startling Changes on the Sun's Surface.

The needle has been found to oscillate through a long cycle of changes, one occupying in its completion a little more than eleven years : that is to say, between the time when the oscillation is least and that when it is greatest there elapses a period of five and a half years, and an equal period before it returns again to its first value. Now, a cycle of changes takes place on the face of the sun agreeing most perfectly with this, not merely in length, but in maximum for maximum, and minimum for minimum.

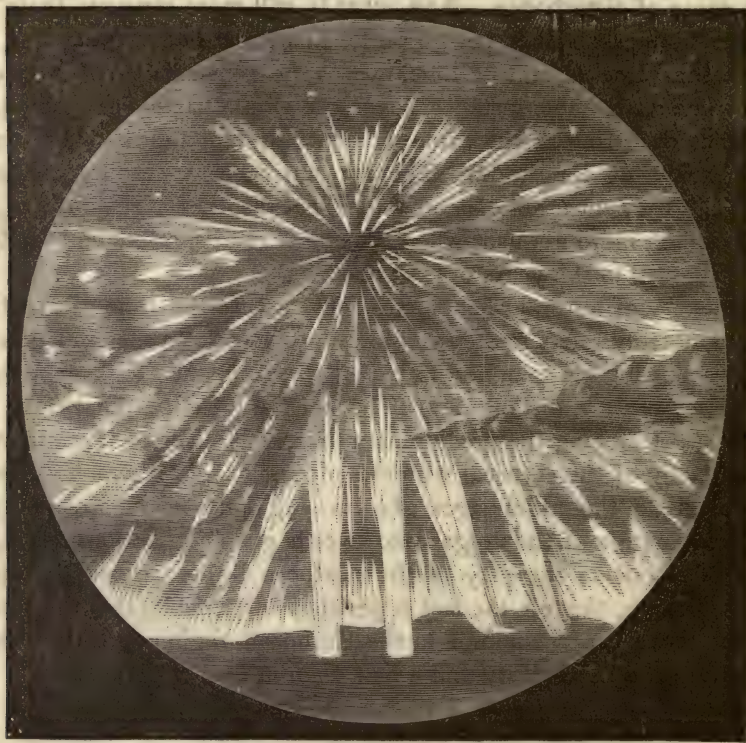
To make this clear, the nature of the facts involved must be stated, and this can be done in no better words than those of Sir John Herschel : "One of the first achievements of the telescope was the discovery of black spots on the surface of the sun. These spots are not permanent, but come and go ; and their number varies greatly. Sometimes his face is quite spotless ; at others, the spots swarm upon it. And as to their actual size, some are comparatively small, others of stupendous extent. One spot which I measured, in 1837, occupied no less than 3,780,000,000 square miles ; another, which was nearly round, would have allowed the earth to drop through it, leaving a thousand miles clear of contact on every side ; and many other instances of much larger spots than these are on record. What are we to think, then, of the awful scale of hurricane



BRILLIANT AURORA BOREALIS IN THE ARCTIC SEAS.

and turmoil and fiery tempest which can in a few days totally change the form of such a region, break it up into distinct parts—open up great abysses in one part, such as I have just described, and fill up others beside them!

“Now it has lately been ascertained by a careful comparison of all the recorded observations of the spots, that the periods of their scarcity and abundance succeed one another at regular intervals of a trifle more than



AURORAL FLAMES IN THE NORTHERN SKY.

five years and a-half: so that in eleven years and one-tenth, or nine times in a century, the sun passes through all its states of purity and spottiness. Now there are two classes of phenomena or facts which occur here on earth which stand in very singular accordance with the appearance and disappearance of the sun's spots. The first is that splendid and beautiful appearance in the sky which we call aurora or northern lights; and which, by comparison of the recorded displays, have been ascertained to be much more frequent in the years when the spots are abundant, and extremely rare in those years when the sun is free from spots.

"The other is a class of facts not so obvious to common observation, but of very great importance to us; because it is connected with the history and theory of the mariner's compass, and with the magnetism of the earth, which we all know to be the cause of the compass needle pointing to the north. But besides this (the oscillations already described), the needle is subject to irregular, sudden, and capricious variations—jerking as it were, aside, and oscillating backwards and forwards without any visible cause of disturbance. And, what is still more strange; these disturbances and jerks sometimes go on for many hours and even days, and often at the same instant of time, over very large regions of the globe; and in some remarkable instances, over the whole earth—the same jerks and jumps occurring at the same moments of time (allowance made for the difference of longitude). These occurrences are called magnetic storms, and they invariably accompany great displays of the aurora; and are very much more frequent when the sun is most spotted, and rarely or never witnessed in the years of few spots."

The history of auroral phenomena goes back to the time of Aristotle, who undoubtedly refers to the exhibition in his work on meteors, describing it as occurring on calm nights, having a resemblance to flame mingled with smoke, or to a distant view of burning stubble, purple, bright red, and blood-color being the predominant hues. Notices of it are likewise found in many of the classical writers; and the accounts which occur in the chronicles of the middle ages, of surprising lights in the air, converted by the imagination of the vulgar into swords gleaming and armies fighting, are allusions to the play of the northern lights. There is strong reason to believe, though the fact is perfectly inscrutable, that the aurora has been much more common in the European region of the northern zone, during the last century and a half, than in former periods.

CHAPTER V.

IMAGES IN THE HEAVENS.

Optical Phenomenon at Buffalo—Topmasts Rising out of the Water—Deceitful Fog Bank—Extraordinary "Fata Morgana" in Sicily—A Spectacle that Excites the Populace—Ascribing the Mirage to the Devil—Prophecy Concerning Electricity—Prismatic Colors of Amazing Beauty—Troops of Clouds in the Sky—Heighth of Clouds—Poetical Fancies from Ossian—Mist on the Water—Accounting for Vapors—What Colors the Sun—The Great Orb Shorn of His Glories—Why the Sun is Red at Rising and Setting—Remarkable Halos—Strange Mock Suns—Parhelia—Historic Halos—What Gassendi Saw—Parhelia Observed by Hevelius—Beautiful Sky Picture in Tennessee—Perfection of Creative Skill—Phenomena of Light—Wonderful Waves and Circles—Light a Magnificent Painter—Innumerable Vibrations.



few years ago, at Buffalo, an amusing optical illusion was observed, which was produced by fog. The following description is from one of the newspapers of that city: "A peculiar appearance was presented in the atmosphere over the lake on Saturday morning, the like of which had never been noticed before by those accustomed to daily intercourse with all the beauties and terrors peculiar to our waters. At an early hour some gentlemen, looking out upon the bay, discovered the top hamper and loftier sails of a vessel, apparently rising from the surface of the water, the hull and lower masts being entirely invisible. Soon another craft, similarly situated, was pointed out, and 'still the wonder grew.' It could not be that both these vessels had foundered and settled down so as to rest upon the bottom, on an even keel; yet there they were, as distinct as possible, sunk to their topmasts, the glassy surface of the water just reaching their lower mast heads.

"A tug was firing up, and when ready slowly steamed out into the lake. For a time there was nothing remarkable in her conduct; but suddenly she too sunk, and there was her smoke stack, just emerging from the deep, and ploughing through it without a ripple. It was a beautiful sight, rendered more so by the perfect placidity of the elements, the bright morning sun, and the soft, balmy temperature. The illusion grew out of a heavy fog bank, which lay upon the surface of the water, but did not obscure objects upon land; thus deceiving the eye as to the true level of the lake."

Of all instances of optical illusion, the *fata morgana*, familiar to the

inhabitants of Sicily, is the most curious and striking. It occurs off the Pharo of Messina, in the strait which separates Sicily from Calabria, and has been variously described by different observers, owing, doubtless, to the different conditions of the atmosphere at the respective times of observation. The spectacle consists in the images of men, cattle, houses, rocks, and trees, pictured upon the surface of the water, and in the air immediately over the water, as if called into existence by an enchanter's wand, the same object having frequently two images, one in the natural and the other in an inverted position. A combination of circumstances must concur to produce this novel panorama. The spectator, standing with his back to the east on an elevated place, commands a view of the strait. No wind must be abroad to ruffle the surface of the sea; and the waters must be pressed up by currents, which is occasionally the case, to a considerable height in the middle of the strait, so that they may present a slightly convex surface.

Strange Appearances on the Water and Above it.

When these conditions are fulfilled, and the sun has risen over the Calabrian heights, so as to make an angle of forty-five degrees with the horizon, the various objects on the shore at Reggio, opposite to Messina, are transferred to the middle of the strait, forming an immovable landscape of rocks, trees, and houses, and a movable one of men, horses, and cattle, upon the surface of the water. If the atmosphere at the time is highly charged with vapor, the phenomena apparent on the water will also be visible in the air, occupying a space which extends from the surface to the height of about twenty-five feet. Two kinds of *morgana* may therefore be discriminated; the first at the surface of the sea, or the marine *morgana*; the second in the air, or the *aërial*. The term applied to this strange exhibition is of uncertain derivation, but supposed by some to refer to the vulgar presumption of the spectacle being produced by a fairy or magician. The populace are said to hail the vision with great exultation, calling every one abroad to partake of the sight, with the cry of "*Morgana, morgana!*"

Brydone, writing from Messina, states: It has often been remarked, both by the ancients and moderns, that in the heat of summer, after the sea and air have been much agitated by winds, and a perfect calm succeeds, there appears about the time of dawn, in that part of the heavens over the straits, a great variety of singular forms, some at rest, and some moving about with great velocity. These forms, in proportion as the light increases, seem to become more *aërial*, till at last some time before sunrise they entirely disappear. The Sicilians represent this as the most

beautiful sight in nature. Leanti, one of their latest and best writers, came here on purpose to see it. He says the heavens appeared crowded with a variety of objects: he mentions palaces, woods, gardens, etc., besides the figures of men and other animals that appear in motion amongst them.

No doubt the imagination must be greatly aiding in forming this aerial



SHIPS PAINTED ON THE SKY BY ATMOSPHERIC REFRACTION.

creation; but as so many of their authors, both ancient and modern, agree in the fact, and give an account of it from their own observation, there certainly must be some foundation for the story.

The common people, according to custom, give the whole merit to the devil; and indeed it is by much the shortest and easiest way of account-

ing for it. Those who pretend to be philosophers, and refuse him this honor, are greatly puzzled what to make of it. They think it may be owing to some uncommon refraction or reflection of the rays from the water of the straits, which, as it is at that time carried about in a variety of eddies and vortices, must consequently, say they, make a variety of appearances on any medium where it is reflected. This, I think, is nonsense, or at least very near it. I suspect it is something of the nature of our aurora borealis, and, like many of the great phenomena of nature, depends upon electrical causes; which in future ages, I have little doubt, will be found to be as powerful an agent in regulating the universe.

The electrical fluid in this country of volcanoes is probably produced in a much greater quantity than in any other. The air, strongly impregnated with this matter, and confined betwixt two ridges of mountains—at the same time exceedingly agitated from below by the violence of the current and the impetuous whirling of the waters—may it not be supposed to produce a variety of appearances? And may not the lively Sicilian imaginations, animated by a belief in demons, and all the wild offspring of superstition, give these appearances as great a variety of forms? Remember, I do not say it is so, and hope yet to have it in my power to give you a better account of this matter.

The Strange Phenomenon Explained.

Ingenious as Brydone was, he here indulges a most unfortunate speculation, which, had he enjoyed the good fortune of personally observing the phenomenon, most likely he would not have proposed. It is to be accounted for upon optical principles, which Biot thus applies: When the rising sun shines from that point whence its incident ray forms an angle of forty-five degrees on the Sea of Reggio, and the bright surface of the water in the bay is not disturbed either by wind or current—when the tide is at its height, and the waters are pressed up by the current to a great elevation in the middle of the channel; the spectator being placed on an eminence, with his back to the sun and his face to the sea, the mountains of Messina rising like a wall behind it, and forming the background of the picture—on a sudden there appear in the water, as in a catoptric theatre, various multiplied objects—numberless series of pilasters, arches, castles, well-delineated, regular columns, lofty towers, superb palaces, with balconies and windows, extended alleys of trees, delightful plains, with herds and flocks, armies of men on foot, on horseback, and many other things in their natural colors and proper actions, passing rapidly in succession along the surface of the sea, during the whole of the short period of time while the above-mentioned causes remain.

The objects are proved, by accurate observations of the coast of Reggio, to be derived from objects on shore. If, in addition to the circumstances already described, the atmosphere be highly impregnated with vapor and dense exhalations, not previously dispersed by the action of the wind and waves, or rarefied by the sun, it then happens that in this vapor, as in a curtain extended along the channel to the height of above thirty feet, and nearly down to the sea, the observer will behold the scene of the same objects not only reflected on the surface of the sea, but likewise in the air, though not so distinctly or well defined.

Lastly, if the air be slightly hazy and opaque, and at the same time dewy, and adapted to form the iris, then the above-mentioned objects will appear only at the surface of the sea, as in the first case, but all vividly colored or fringed with red, green, blue, or other prismatic colors.

The ancient classical fable of Niobe on Mount Sipylus belongs to the same category of atmospheric deceptions; and the tales common in mountainous countries, of troops of horse and armies marching and counter-marching in the air, have been only the reflection of horses pasturing upon an opposite height, or of the forms of travellers pursuing their journey.

A View of Cloud-Land.

The formation of visible vapors, and their aggregation in masses, take place generally in high regions of the atmosphere under the action of currents, in consequence of a decrease of temperature and a due supply of aqueous elastic vapor being present in those parts where clouds arise. It is easy to perceive that these two conditions, necessary to the production of cloud-land, may be fulfilled in one stratum of the atmosphere and not in another; and hence the frequent diversity in the appearance of the sky, the clear blue fields and patches of ether alternating with visible vaporous structures.

The clouds are supposed to consist of minute globules of water filled with air; but there is great difficulty, even with the aid of this view of their structure, in explaining their suspension aloft, for the globules must be specifically heavier than the air by which they are upborne. The theory of ascending currents of heated air has been proposed by Lussac to account for their position; and the retention of solar heat in the clouds themselves, buoying them up and causing them to float, by Fresnel.

The clouds float at different elevations, but the higher we ascend the drier the atmosphere is found, and the less loaded with vapors. We shall not err much, says Leslie, if we estimate the position of extreme humidity at the height of two miles at the pole, and four miles and a half under the equator, or a mile and a half beyond the limit of congelation. Dalton



REMARKABLE APPEARANCES OF CLOUD-LAND.

asserts that small, fleecy patches of cloud are frequently from three to five miles in height, and such have been observed sailing above the most elevated peaks of the Andes, which rise twenty-five thousand feet above the level of the sea; but other authorities claim for some visible clouds a still greater elevation. The height varies at different seasons of the year, and there is little doubt that it is much more frequently below than above a mile.

The effect is striking when, from an eminence which commands a view of an extensive plain or valley, we see the gossamer curtain of the night resting upon the surface, gradually rent and torn by the action of the sun's rays, reflecting their golden hue as it disappears. Many of the most felicitous images of poetry are derived from this source, as in Ossian: "The soul of Nathos was sad, like the sun in a day of mist, when his face looks watery and dim;" and again, when two contending factions are silenced by Cathmor: "They sunk from the king on either side, like two columns of morning mist, when the sun rises between them on the glittering rocks."

Why Mists Settle Over Rivers.

The stratus is occasionally seen under peculiar and striking circumstances, extending over the surface of a sheet of water, without passing the boundary of its banks. Thus a lake or river will exhibit a white cloud of visible vapor rising upon it, from which the adjacent land is perfectly free. Sir Humphry Davy thus explains this curious phenomenon: "All persons who have been accustomed to the observation of nature must have frequently witnessed the formation of mists over the beds of rivers and lakes in calm and clear weather after sunset; and whoever has considered these phenomena in relation to the radiation and communication of heat and the nature of vapor, can hardly have failed to discover the true cause of them. As soon as the sun has disappeared from any part of the globe, the surface begins to lose heat by radiation, and in greater proportions as the sky is clear; but the land and water are cooled by this operation in a very different manner: the impression of cooling on the land is limited to the surface, and very slowly transmitted to the interior; whereas in water above forty degrees Fahrenheit, as soon as the upper stratum is cooled, whether by radiation or evaporation, it sinks in the mass of fluid, and its place is supplied by water from below; and till the temperature of the whole mass is reduced to nearly forty degrees Fahrenheit, the surface cannot be the coolest part.

"It follows, therefore, that wherever water exists in considerable mass, and has a temperature nearly equal to that of the land, or only a few

degrees below it, and above forty degrees Fahrenheit at sunset, its surface during the night, in calm and clear weather, will be warmer than that of the contiguous land; and the air above the land will necessarily be colder than that above the water; and when they both contain their due proportion of aqueous vapor, and the situation of the ground is such as to permit the cold air from the land to mix with the warmer air above the water, mist or fog will be the result."

What Colors the Sun.

The atmosphere of our globe is composed mainly of two gases, oxygen and hydrogen, whose combination forms a perfectly transparent medium. In this medium, however, there floats at all times a vast quantity of aqueous vapor, raised daily by the heat of the sun, in the form of steam, from the surface of the sea and of the dry land. The amount of water thus lifted into the air by the process of evaporation is very great, and far exceeds that discharged into the ocean, during the same length of time, by all the rivers of the earth.

The aqueous vapor produced in this manner is diffused through the whole body of the atmosphere, and is in a state of perpetual motion and change, being rarefied into an invisible condition, or condensed into mists and clouds, according to the varying degrees of heat or cold to which it is exposed; and in this way it affects, sometimes more and sometimes less, the general transparency of the air, and modifies both the colors and the forms of objects seen through it. And in the present chapter we are to speak of the various aspects which it gives to the solar orb.

The sun, viewed through a vaporous atmosphere, appears in "false colors." When the vapor is dry and rarefied, or in an invisible condition, the air is clear, and the sun is seen in his natural brightness. But if the vapor be slightly condensed, and takes the form of mist, he appears through it as if shorn of his glories, a white orb, upon which the eye can rest without pain or inconvenience; as he descends he grows still more dull; and finally, as he approaches the horizon, he gradually assumes a rosy tint, and at last a deep red color. These changes are thus explained. Every ray of the sunlight which comes to us has to pass through the whole thickness of the atmosphere, and the greater the distance it has to travel the greater the portion of it that is absorbed by the vapors in the air. And this distance, as is obvious, increases with the increased declination of the sun.

If we admit the atmosphere to extend vertically to the height of sixty-two miles, a ray of light coming from the sun at the zenith has only these sixty-two miles to pass through in order to reach us. But a ray from the

sun on the horizon has to travel through 706 miles, or more than eleven times the former distance, and that, too, through the densest portion of the atmosphere. In traversing this great distance, the various colors combined in the perfectly white ray, except the red, are, for the most part, absorbed by the slowly condensing vapors along the cooling surface of the earth. Hence the red color in which the sun appears at its setting and rising.

What Changes the Sun's Apparent Form.

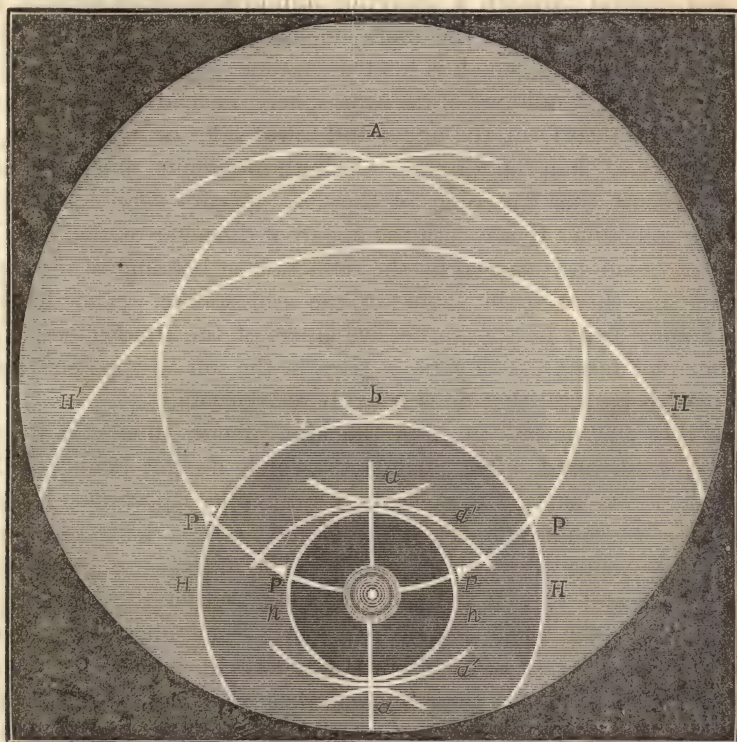
The sun, viewed through a vaporous atmosphere, often appears, also, in a "false form." Seen on the meridian, through a clear sky, he appears as a perfect circle, which is his true outline. But as seen near the horizon, in certain conditions of the atmosphere, instead of being circular, he appears of an oval form, the upper and lower sides being flattened, and the latter more so than the former. On high mountains, and on plateaux near the seacoast, this flattening of the disk appears very considerable, amounting sometimes to one-fifth the apparent diameter of the sun. This peculiar deformation is caused by the refraction or bending of the rays of light in passing through the vapors of the atmosphere. Sometimes the want of homogeneity in the successive layers of the atmosphere, caused by the unequal admixture of vapors, gives to the sun an apparent form of so irregular a character that he is scarcely recognizable.

Again, the sun, viewed through the atmospheric vapors, in a certain state, appears surrounded by appendages which do not belong to him. When the sky is hazy, and presents a dull, milky appearance, there is frequently to be seen around the sun a colored circle, or halo, and the sun occupying the centre of the circle, as *h h*. The inner edge of the circle is colored red, and is well defined. The sky within the halo is much darker than it is for some distance without. Sometimes there may be seen around the sun a second halo or colored circle, as *H H*. The inner edge of this also is red, and tolerably well defined, while the outer edge is of a pale blue color, and but faintly marked. At rare intervals, a third halo, radius, as *H' H'*, has been observed, surrounding the sun. Unlike the other two halos, this one shows scarcely a trace of color.

All these phenomena are produced by the refraction of the sunlight in passing through the minute crystals of frozen vapors floating in the atmosphere; these crystals being of various kinds and having their facets set at different inclinations to one another, refract the various colors of the sunrays at different angles, and thus produce halos of different diameters.

When a halo is formed around the sun, there is often to be seen a

white circle passing through the sun, and parallel to the horizon, as represented by A P P. This is called parhelic circle, and is produced like the foregoing by the reflection of the sun's light from ice prisms or snow crystals, whose surfaces have a vertical position. At or near those points where halos cut the parhelic circle, there is a double cause of light; and here the illumination is sometimes so great as to present the appearance of a mock-sun, and is called parhelion. The number of these mock-suns, or parhelia, visible at the same time, is variable; sometimes one or

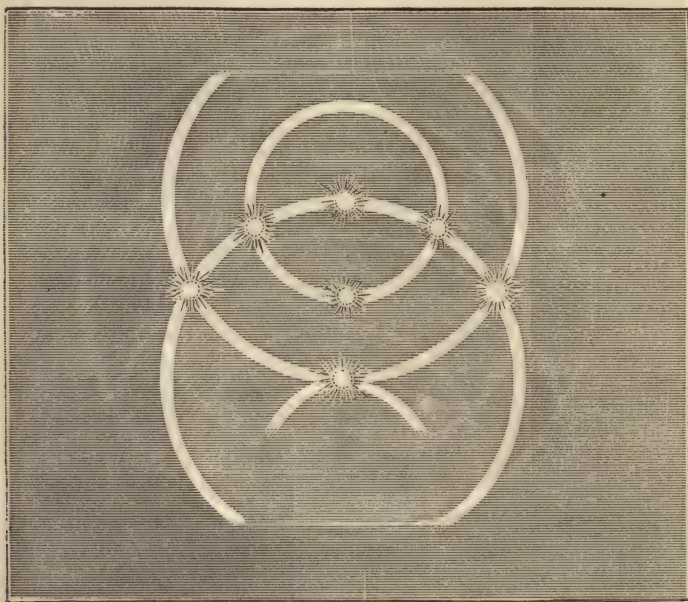


HALOS AND PARHELIA.

two only are to be seen, at other times four or five; on some occasions as many as seven have been observed at once. The mock-suns generally seem about the size of the true sun, but not quite so bright, though occasionally they are said to rival their parent luminary in splendor. These beautiful phenomena appear most commonly in high latitudes, but often occur in the more temperate regions.

Parhelia have been observed frequently both in ancient and modern times. Aristotle records two appearances of these meteors, and Pliny

mentions their occurrence at Rome. A double parhelion, which was noticed before the Christian era, is referred to by St. Augustine. Many others have been observed from different points on the continent. On the 2d of January, 1586, Christopher Rotham saw, at Cassel, before sunrise, an upright column of light of the breadth of the sun's disk. As he rose to view, he was preceded and followed by a parhelion, which appeared in contact with his orb, and continued visible for thirty minutes, and then were hidden by a cloud. On the 28th of February, 1551, mock-suns were seen at Antwerp; and on the 17th of March of the same year, a similar phenomenon, with two halos, was witnessed at the same place.



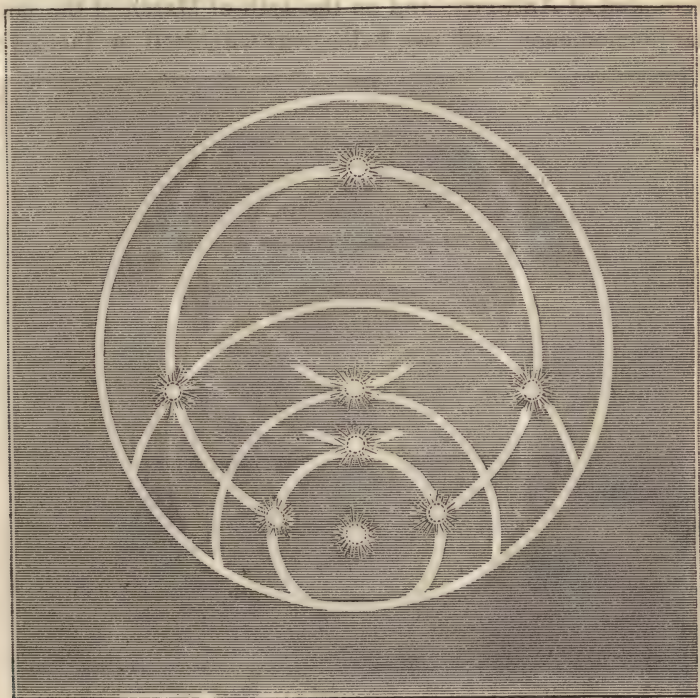
PARHELIA OBSERVED BY GASSENDI.

Four days after the last named, two parhelia, with three halos, were seen at Magdeberg.

Scheiner witnessed a singular one at Rome, on the 20th of March, 1629. From the zenith as a centre there was seen a great white circle, having the true sun in its circumference; this was intersected by two concentric circles around his disk. Where the outer of these smaller rings cut the zenithal circle, two parhelia appeared, and in the great circle, nearly opposite to these, but separated by a wider arc, two others were visible.

Gassendi describes a very remarkable instance of this phenomenon,

which was seen in 1630. Around the sun were two concentric halos; the larger cut the horizon, and consequently was incomplete; these were colored like the rainbow, excepting that the red was internal. In the direction of the zenith, there was a tangential arc external to these halos; and with the zenith as a centre, a great white circle ran parallel with the horizon, having the true sun in its circumference. At the five intersections of these circles and arcs parhelia appeared, and a sixth was seen in the internal halo between the true sun and the zenith.

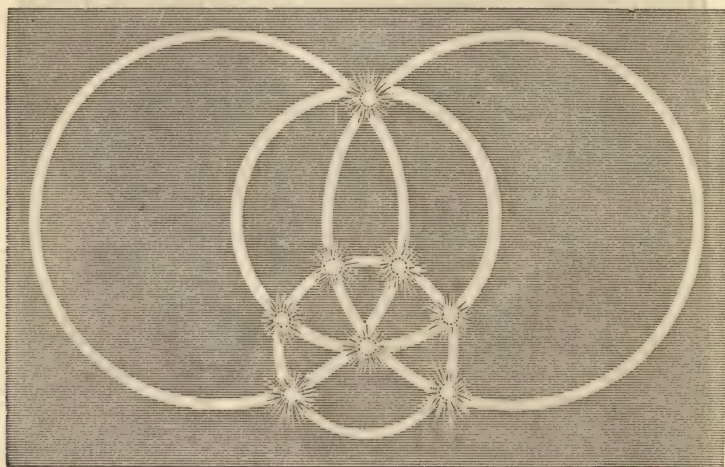


PARHELIA OBSERVED BY HEVELIUS.

One of the finest meteors of this kind on record was seen by Hevelius, at Sedan, on the 20th of February, 1661. "A little before 11 o'clock," he says "the sun being towards the south and the sky very clear, there appeared seven suns together, in several circles, some white and others colored, and these with very long tails waving and pointing from the true sun, together with certain white arches crossing one another. The true sun was about 25° high, and surrounded almost entirely by a circle whose diameter was about 45° , and colored like a rainbow with purple, red and yellow, its under limb being scarcely $2\frac{1}{2}^{\circ}$ above the horizon. On each side of

the sun, towards the west and east, there appeared two mock-suns, colored, especially towards the sun, with very long and splendid tails of a whitish color, terminating in a point. A far greater circle encompassed the sun and the former lesser circle, and extended itself down to the horizon. It was very strongly colored in its upper part, but was somewhat duller and fainter on each side. At the tops of these two circles were two inverted arcs, whose common centre lay in the zenith, and these were very bright and beautifully colored.

In the middle of the lower arc, where it coincided with the circle, there appeared another mock-sun, but its light and colors were dull and faintish. There appeared a circle much bigger than the former, of a uniform and whitish color, parallel to the horizon, which arose as it were from the col-



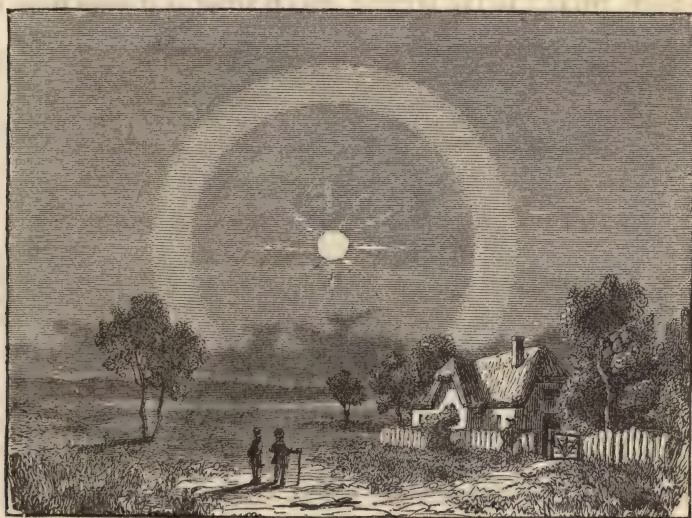
PARHELIA OBSERVED IN TENNESSEE.

lateral mock-suns, and passed through three other parhelia, of a uniform whitish color like silver. There passed also two other white arches of the greatest circle of the sphere through the eastern and western parhelia, and also through the pole of the ecliptic. They went down to the horizon, crossing the great white circle and obliquely, so as to make a white cross at each parhelion; so that seven suns appeared very plainly at the same time. This phenomenon, with certain changes in the brightness of its several parts, continued visible for an hour and twenty minutes."

Such parhelia have been observed at various times and places in North America. Barker describes a curious halo with accompanying mock-suns, which he saw at Fort Gloucester, near Lake Superior. A circle with tangential arc surrounded the sun; about midway between the hori-

zon and zenith, a circle ran parallel to the horizon, having the sun in its circumference; in this horizontal circle there appeared altogether five mock-suns, with this peculiarity, that, directly opposite the true sun in this great circle, a St. Andrews cross was seen, the upper limbs of which extended higher above, than the lower one descended below, this circle; in the intersection of this cross and the circle, one of the parhelia was placed. A very curious system of circles, with several mock-suns, appeared on the 19th of August, 1825, at Jackson, Tennessee.

An exceedingly curious optical appearance belonging to this class of phenomena, was observed by Mr. Fallows, at the Cape of Good Hope, when the sun's disk was just dipping in the ocean. On either side of the



BRIGHT HALO IN NORWAY.

true luminary, and within the breadth of a degree and a half of his disk, four mock-suns appeared on the left, and three on the right. They had the same shape as the true sun, touched the water at the same instant, and all of them disappeared together, shining as bright spots upon the water's edge. This magnificent scene occurred on a delightful evening, when not a cloud was to be seen.

Such are a few of the marvelous appendages which the vapors of the atmosphere sometimes create around the great luminary of the day.

Now, evanescent as is the nature of all these meteoric phenomena at which we have glanced, and irregular as their occurrence may be, yet they are in no sense to be regarded as the result of chance. On the

contrary, we see in them the play of exact and beautiful laws. All are produced according to the principles of order established, in the beginning, by the One Supreme Lawgiver. In all, brightness and shade prevail in their ordained degrees; and heat and cold produce their designed effects in sea and land and sky. The sunrays in their passage through visible mists, or viewless vapors, are reflected, refracted, and absorbed, according to uniform rules.

The diameters, distances and intersections of the encircling halos are all measured off after the undeviating principles of geometry. Every tint and shade in their coloring, and every facet and angle in the frozen particles that produce them, display the operations of the unerring laws of optics. Invisible vapors, icy crystals, luminous arches, colored halos, splendid parhelia—all proclaim the observance of law and order. And though the whole magnificent diorama may fade and vanish within the brief space of five minutes, yet, in its production, nothing has been slighted, nothing imperfectly formed, nothing left to be determined by chance.

Marvelous Waves of Light.

If a pebble be dropped into the bosom of a still and smooth sheet of water, a circular depression is formed, at the point where it sank, which spreads wider and wider, with uniform velocity. In the meanwhile an elevation has been formed at the point where the pebble, in entering the water, had originally caused a depression; then as this sinks back to its original level it produces a wall-like circular elevation around it, which follows up the preceding circular depression with equal velocity. Whilst the water continues its up-and-down movement at the point struck, fresh wave-rings appear to proceed from this central point, which, owing to their constantly spreading more and more widely, give the illusory appearance of the fluid streaming out on all sides from the middle point.

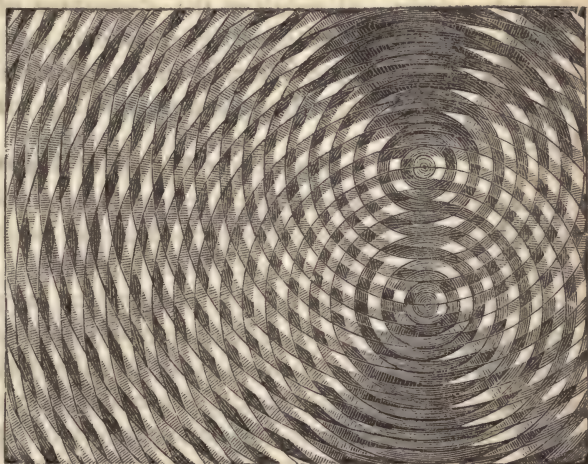
Now, let us suppose that, instead of one pebble, two are dropped into the water at the same instant, but at a short distance one from the other. We shall have then two systems of circular waves moving and spreading out as before. As these two systems intersect each other, they divide the surface of the water into a regular net-work of small elevations and depressions, as represented in the annexed figure. Yet the one does not destroy or efface the other; at the points where two wave-crests meet, the surface of the water, if the two waves are equal, rises to twice the height, and where two depressions meet, it sinks to double the depth. Thus each wave maintains and extends unbroken its circular and moving form, as if it had the entire surface to itself. And if, instead of two, we had three,

or in fact, any number of pebbles dropped, the same result would be produced by each of them. In other words, it may be said, that every wave system superimposes itself upon, or adds itself to, a surface already moved by waves, as it would do were it acting alone on that surface at rest. Every wave system forms itself unhindered by those already present, and spreads after it has crossed these, upon the still quiescent surface of the water as if it had suffered no interruption in its outward progress.

Once more: suppose that when we have flung a handful of pebbles upon the water, each creating its little system of spreading waves, a succession of large billows or swells be produced by the wind or a passing steamboat, we shall see that even these do not destroy the little waves of the pebbles, but take them on their backs, and having passed, leave them behind with their original forms and motions unaltered. Of all this we may witness a beautiful illustration when large drops of rain begin to fall upon the agitated surface of a lake or river.

Now, similar results, though invisible, are produced in the atmosphere by a blow on a drum or a bell, or by any number of such blows given in succession. These ærial vibrations, like the waves upon the water, do not destroy or extinguish one another. If a whole orchestra, composed of numerous and diverse instruments, play a piece of music together, each pipe and each string will create its own system of vibrations, which will pass outward through the atmosphere without disorder, each being endowed with an individuality as indestructible as if it alone had disturbed the quietude of the still air.

If now we advance to the far more attenuated and elastic medium of light, the ether, we shall find the same law still hold good. Here, as in the water and in the air, one system of vibrations, whether set in motion immediately by the sun, or by reflection of the sun's rays from some



INTERSECTION OF TWO WAVE SYSTEMS.

terrestrial object, does not interrupt or confuse another system. Each, though it may have crossed a hundred or a thousand others, maintains its existence and its identity unchanged, and bears on its bosom a correct and clear representation of the centre or object from which it has proceeded. These radiant vehicles of light are infallible in their progress and office; from ten thousand points, and in ten thousand directions, they unceasingly carry and imprint the messages of the world and of the universe. If we enter the garden, and bend over a bed of diverse flowers, we shall find that each green leaf and each variegated petal sends forth its little system of ethereal vibrations, announcing infallibly its particular form and color. If we stand confronted by a regiment of soldiers, the countenance of each individual, in like manner, sends forth its system of vibrations, and all meet in the eye, and imprint their pictures of those countenances on the retina within a circle that does not exceed in circumference that of a dime—not one is omitted; not one is blurred.

A Stupendous Marvel of Creation.

If we look out on the broad landscape, each of its great features and countless objects does the same. And if we lift our eyes to the heavens on a clear night, vibratory waves still issue from those uncounted stars as their centres, and like the circles created by the drops of a shower on the surface of a lake, cross, coincide, oppose, and pass through each other without confusion or extinction. The waves of the zenith do not jostle out of existence those from the horizon, nor those from the horizon such as descend from the zenith, but each star, wherever situated, is clearly seen across all the entanglement of wave-motions produced by all other stars. The eye receives as perfect and distinct an impression of each, as if no other shone in the whole celestial concave.

What a marvel of creation, then, have we in this ethereal element—its illimitable extent, its inconceivable tenuity, its undecaying elasticity, its countless and instantaneous vibrations—without which the earth, and the stars, and even the sun itself would have been wrapped in eternal darkness! And what an organ have we in the eye, with its congeries of related parts, to adapt it to receive and interpret these ether vibrations without effort or delay, and thus derive from it a thousand advantages and pleasures every hour! And to what shall we ascribe all this? To chance? Sooner let us say that the pictures of Raphael have been produced by the dashing of the waves; or that the unerring chronometer, which guides the mariner over the trackless main, has resulted from the fortuitous dancing of a cloud of dust.

CHAPTER VI.

STRANGE WANDERERS THROUGH SPACE.

Sudden Appearances—Unusual Phenomena—Great History of the Heavens—Bodies Governed by Solar Attraction—Elongated Orbits—Marvelous Comet of 1680—Period Estimated at Three Thousand Years—Thousands of Miles in a Minute—Sir Isaac Newton's Prediction—Halley's Comet—A Frightened Emperor—Shocking Calamities Supposed to be Foreshadowed—Visitation During a Bloody War—Hideous Faces and Bristling Hair—Byron's Graphic Description—Substance of Comets—Thin Vapor—A Comet Enveloping Jupiter—The Poet Conder's Apostrophe.

THOSE tailed bodies, which suddenly come to light up the heavens, were long regarded with terror, like so many warning signs of divine wrath. Men have always thought themselves much more important than they really are in the universal order; they have had the vanity to pretend that the whole creation was made for them, whilst in reality the whole creation does not suspect their existence. The earth we inhabit is only one of the smallest worlds; and therefore it can scarcely be for it alone that all the wonders of the heavens, of which the immense majority remains hidden from it, were created.

In this disposition of man to see in himself the centre and the end of everything, it was easy indeed to consider the steps of nature as unfolded in his favor; and if some unusual phenomenon presented itself, it was considered to be without doubt a warning from heaven. If these illusions had had no other result than the amelioration of the more timorous of the community one would regret those ages of ignorance; but not only were these fancied warnings of no use, seeing that once the danger passed, man returned to his former state; but they also kept up among people imaginary terrors, and revived the fatal resolutions caused by the fear of the end of the world.

The history of a comet would be an instructive episode of the great history of the heavens. In it could be brought together the description of the progressive movement of human thought, as well as the astronomical theory of these extraordinary bodies. Let us take, for example, one of the most memorable and best-known comets, and give an outline of its successive passages near the earth. Like the planetary worlds, comets

belong to the solar system, and are subject to the rule of the Star King. It is the universal law of gravitation which guides their path; solar attraction governs them, as it governs the movement of the planets and the small satellites.

The chief point of difference between them and the planets is, that their orbits are very elongated; and, instead of being nearly circular, they take the elliptical form. In consequence of the nature of these orbits, the same comet may approach very near the sun, and afterwards travel from it to immense distances. Thus, the period of the comet of 1680 has been estimated at 3000 years. It approaches the sun, so as to be nearer to it than our moon is to us, whilst it recedes to a distance 853 times greater than the distance of the earth from the sun. On the 17th of December, 1680, it was at its perihelion—that is, at its greatest proximity to the sun; it is now continuing its path beyond the Neptunian orbit. Its velocity varies according to its distance from the solar body. At its perihelion it travels thousands of leagues per minute; at its aphelion it does not pass over more than a few yards. Its proximity to the sun in its passage near that body caused Newton to think that it received a heat 28,000 times greater than that we experience at the summer solstice; and that this heat being 2000 times greater than that of red-hot iron, an iron globe of the same dimensions would be 50,000 years entirely losing its heat.

Singular Prediction of Newton.

Newton added that in the end comets will approach so near the sun that they will not be able to escape the preponderance of its attraction, and that they will fall one after the other into this brilliant body, thus keeping up the heat which it perpetually pours out into space. Such is the deplorable end assigned to comets by the author of the "*Principia*," an end which makes De la Bretonne say to Rétif: "An immense comet, already larger than Jupiter, was again increased in its path by being blended with six other dying comets. Thus displaced from its ordinary route by these slight shocks, it did not pursue its true elliptical orbit; so that the unfortunate thing was precipitated into the devouring centre of the sun." "It is said," added he, "that the poor comet, thus burned alive, sent forth dreadful cries!"

It will be interesting then, in a double point of view, to follow a comet in its different passages in sight of the earth. Let us take the most important in astronomical history—the one whose orbit has been calculated by Edmund Halley, and which was named after him. It was in 1682 that this comet appeared in its greatest brilliancy, accompanied with a tail which did not measure less than thirty-two millions of miles. By the

observation of the path which it described in the heavens, and the time it occupied in describing it, this astronomer calculated its orbit, and recognized that the comet was the same as that which was admired in 1531 and 1607, and which ought to have reappeared in 1759. Never did scientific prediction excite a more lively interest. The comet returned at the appointed time; and on the 12th of March, 1759, reached its perihelion. Since the year 12 before the Christian era, it had presented itself twenty-four times to the earth. It was principally from the astronomical annals of China that it was possible to follow it up to this period.

An Emperor Terribly Frightened.

Its first memorable appearance in the history of France is that of 837, in the reign of Louis le Débonnaire. An anonymous writer of chronicles of that time, named "the Astronomer," gives the following details of this appearance, relative to the influence of the comet on the imperial imagination:

During the holy days of the solemnization of Easter, a phenomenon ever fatal and of gloomy foreboding, appeared in the heavens. As soon as the Emperor, who paid attention to these phenomena, received the first announcement of it, he gave himself no rest until he had called a certain learned man and myself before him. As soon as I arrived, he anxiously asked me what I thought of such a sign; I asked time of him, in order to consider the aspect of the stars, and to discover the truth by their means, promising to acquaint him on the morrow; but the Emperor, persuaded that I wished to gain time, which was true, in order not to be obliged to announce anything fatal to him, said to me: "Go on the terrace of the palace and return at once to tell me what you have seen, for I did not see this star last evening, and you did not point it out to me; but I know that it is a comet; tell me what you think it announces to me." Then scarcely allowing me time to say a word, he added: "There is still another thing you keep back: it is that a change of reign and the death of a prince are announced by this sign." And as I advanced the testimony of the prophet, who said: "Fear not the signs of the heavens as the nations fear them," the prince with his grand nature and the wisdom which never forsook him, said, "We must only fear Him who has created both us and this star. But as this phenomenon may refer to us, let us acknowledge it as a warning from Heaven."

The Comet Supposed to Bring Awful Calamities.

Louis le Débonnaire gave himself and court to fasting and prayer, and built churches and monasteries. He died three years later, in 840, and historians have profited by this slight coincidence to prove that the appear-

ance of the comet was a harbinger of death. The historian, Raoul Glaber, added later: "These phenomena of the universe are never presented to man without surely announcing some wonderful and terrible event."

Halley's comet again appeared in April 1066, at the moment when William the conqueror invaded England. It was pretended that it had the greatest influence on the fate of the battle of Hastings, which delivered over England to the Normans.

A contemporary poet, alluding probably to the English diadem with which William was crowned, had proclaimed in one place, "that the comet had been more favorable to William than nature had been to Cæsar; the latter had no hair, but William had received some from the comet." A monk of Malmesbury apostrophized the comet in these terms: "Here thou art again, thou cause of the tears of many mothers! It is long since I have seen thee, but I see thee now, more terrible than ever; thou threatenest my country with complete ruin!"

In 1455, the same comet made a more memorable appearance still. The Turks and Christians were at war, the West and the East seemed armed from head to foot—on the point of annihilating each other. The crusade undertaken by Pope Calixtus III. against the invading Saracens, was waged with redoubled ardor on the sudden appearance of the star with the flaming tail. Mahomet II. took Constantinople by storm and raised the siege of Belgrade. But the Pope having put aside both the curse of the comet and the abominable designs of the Mussulmans, the Christians gained the battle, and vanquished their enemies in a bloody fight. The *Angelus* to the sound of bells dates from these ordinances of Calixtus III. referring to the comet.

Blood and Hideous Faces.

Comets like those of 1577 appear, moreover, to justify by their strange form the titles with which they are generally greeted. The most serious writers were not free from this terror. Thus, in a chapter on celestial monsters, the celebrated surgeon, Ambrois Paré, described the comet of 1528 under the most vivid and frightful colors: "This comet was so horrible and dreadful that it engendered such great terror to the people, that they died, some with fear, others with illness. It appeared to be of immense length, and of blood color; at its head was seen the figure of a curved arm, holding a large sword in the hand as if it wished to strike. At the point of the sword there were three stars, and on either side were seen a great number of hatchets, knives, and swords covered with blood, amongst which were numerous hideous human faces, with bristling beards and hair." The imagination has good eyes when it exerts itself.

In the last century, people still believed in the terrible power of these unhappy stars. In the present day, and especially since the famous comet of 1811, country people have imagined rather that they predicted excellent vintages. These ideas are as void of proof as the former. Although these bodies have greatly lost their prestige, they have not been entirely despoiled of it. Moreover, who could efface the impression produced by some of their aspects? Often they have been considered as signs of curses hovering over men and empires. Such is the lamentation of Byron in "Manfred," to whom the seventh spirit addresses the following words:

The star which rules thy destiny
Was ruled, ere earth began, by me :
It was a world as fresh and fair
As e'er revolved round sun in air :
Its course was free and regular,
Space bosom'd not a lovelier star.
The hour arrived—and it became
A wandering mass of shapeless flame,
A pathless comet, and a curse,
The menace of the universe ;
Still rolling on with innate force,
Without a sphere, without a course,
A bright deformity on high,
The monster of the upper sky !

Nevertheless, nothing proves that comets are gifted with any influence whatever, we do not say on the morals of men, but on the physics of the world. Their lightness, the extreme diffusion of their substance, induces us to believe rather that they possess no kind of action on the planets. At their approach to the sun, their substance distends itself, assumes a wonderful size, and develops itself over an expanse of many million leagues. They are of such lightness and suppleness that a ray of heat may, at its will, cause them to take any shape; you have an instance of this lightness in the comet that was observed in 1862; the form and position of the luminous appendages changed from day to day; and observers might have believed that even a portion of the substance of the nucleus flowed into space

Comets Only Thin Vapor.

Two thousand years ago, Seneca wrote: A day will come when the course of these bodies will be known, and submitted to rules, like that of the planets. The prophecy of the philosopher is realized. It is now known that like the planets, comets gravitate round the sun, and depend equally on its central attraction. Only, instead of moving in orbits, circular, or nearly so, they describe oval curves—very long ellipses. This

is the great distinction established between them and planets. Instead of being opaque, heavy, and important bodies like our planets, they are of great lightness, and extreme tenuity. One day, a comet carried away by its rapid march, traversed the system of Jupiter, the satellites and the planets for some hours surrounded by the comet; and when the body had passed over them, they had not undergone the slightest deviation in their path. When Maupertuis, wishing to explain the origin of Saturn's ring, thought he had conceived an ingenious idea in attributing this appendage to the tail of a comet which was wound round the planet, he did not dream of the extreme rarity of these impotent vapors.

The distinctive character of comets lies especially in the length of their course, and in the immense duration of their journeys round the sun, through the celestial regions. The following lines are by the poet Conder:—

Mysterious visitant, whose beauteous light
Among the wondering stars so strangely gleams!
Like a proud banner in the train of night,
The emblazon'd flag of Deity it streams—
Infinity is written on thy beams;
And thought in vain would through the pathless sky
Explore thy secret course. Thy circle seems
Too vast for Time to grasp. Oh, can that eye
Which numbers hosts like thee, this atom earth descry?

CHAPTER VII.

MONSTERS AND SUPERSTITIONS.

Former Belief in Astrology—Strange Fancies—Olaus Magnus and his Absurdities—Droll Description of the Great Sea-Serpent—The Monster Attacking a Ship—Statement by a Bishop—Cooking a Meal on the Back of a Leviathan—Legendary History of Trees and Plants—Trees Bearing Water-Birds—Story of a Marvelous Tree in Scotland—Belief of Scientific Men in Ridiculous Fables—Queer Lightning Rod—Charlatans and Greenhorns—Roots of the Mandragora Carved into Fantastic Shapes—Life Preserver of Gods and Animals—Alarming Eclipses.



WE have seen in the preceding chapter that the human mind can turn its imaginations into supposed facts, and accept absurdities as logical conclusions. We might have enlarged upon the superstitious notions regarding comets. There was a time when celestial omens were consulted on all possible occasions, and a firm belief in astrology was common even among those who were best educated and most intelligent.

As evidence of this disposition to believe in the marvelous and even the absurd, we give here an account of some of the strange fancies concerning monstrous creatures which were thought to exist in the sea. Thus in a renowned work published in 1555, Olaus Magnus makes some amazing statements about the great sea-serpent, then believed to roam the great deep.

The author does not rest satisfied with giving a description of this creature; he delineates it, and in his engravings we see the reptile issuing from the waves, and landing itself upon the ships in order to devour the crews. Elsewhere the Bishop of Upsala represents cetacea which crush ships in their formidable jaws!

And yet though it seems incredible, our epoch, in respect to the history of marine monsters, leaves the old legends of the middle ages far behind. In fact it is impossible to dream of anything more fabulous than what Denis de Montfort in comparatively recent times gave out as a feast for the credulous. His mind must really have been diseased.

The lucubrations of this naturalist have found a place in the great edition of Buffon's works. He there states, without the least hesitation, that in the northern seas there are cuttle-fish of such a size that a whale is a pigmy in comparison with them. According to him these mollusks

are even of such prodigious dimensions, that when they rest motionless and half out of the water their bodies, which ages have covered with tufts of marine plants, have sometimes been taken for islands floating on the surface of the waves. It is even related in some old Scandinavian chronicles that sailors, deceived by this treacherous sign, have been known to anchor their ships on the flanks of these sea monsters, and land on their backs.

In those times of credulity, when the life of the sailor was so full of anxiety and terror, such facts were held to be quite authentic. Thus we see Olaus Magnus represent in one of his works a company of fishermen warming themselves and cooking their food at a glowing fire lighted on the body of one of these fantastic creatures; but the author has sketched



ANCIENT SEA-SERPENT : FACSIMILE FROM OLAUS MAGNUS.

a cetacean, not a polypus. Gesner, a zoologist of the middle ages, seems to believe such fables, for he reproduces the figure given by the learned Swede.

In the wide field of absurdities, Denis de Montfort displays credulity almost surpassing belief. He asserts, with a strong sense of conviction, that amid these great seas there are gigantic cuttle-fish, which, by means of their immense arms thickly covered with suckers, encircle ships and wreck them by plunging them into the abyss.

The naturalist even attributes the inexplicable disappearance of some of our ships to these formidable tenants of the ocean. He is so convinced of the truth of this fact, that he devotes one of the plates of Buffon's work to the exhibition of it. We there see a monstrous cuttle-fish with flaming eyes, the horrible arms of which are twined round the masts of a ship

of war, which they are tightly straining, while the animal looks as if it would devour it.

Trees themselves and plants, notwithstanding their calm and peaceful life passed in the broad light of day, have still their legendary history and their superstitious traditions. Some have become celebrated on account of the strange animated progeny which has been attributed to their leafy tops; others for their medical or cabalistic power. Rousseau complained that plants had been defiled by transforming them into disgusting remedies. We should be more correct in accusing those who attribute ridiculous virtues to them.

Several water-birds were long considered to be the produce of certain trees which grow in the marshes or borders of the sea. Our credulous



MONSTER ATTACKING A SHIP: FROM OLAUS MAGNUS.

forefathers were persuaded that there was one of these growing in Scotland or the Orkneys, the fruits of which, as large as eggs and having the same shape, opened at maturity and allowed each little duck to escape.

The vulgar would not have dared to doubt such a fact, for it was quoted by the most renowned scholars. Sebastian Munster attests the truth of it in his great work on "Cosmography."

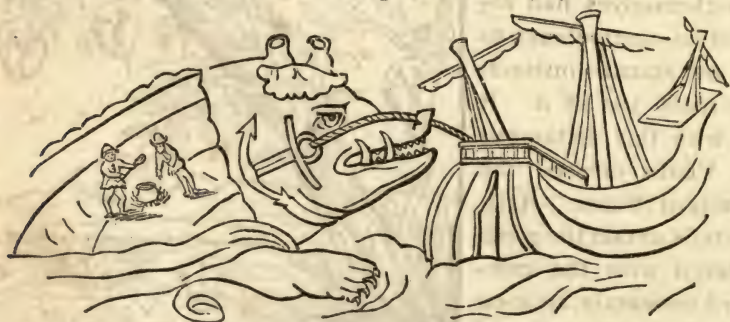
"We find," he says, "trees in Scotland which produce a fruit enveloped in leaves, and when it drops into the water at a suitable time, it takes life and is turned into a live bird, which they call a tree-bird." In order to produce a still fuller proof, the writer himself gives a drawing of it! We see the young ducks opening the fruits in order to escape, whilst the newly-hatched ones swim in the water near at hand!

But the case becomes still more serious when we see the most learned

ornithologist of his time, Aldrovandus, propagate such ridiculous fables in his great work. He there maintains that sea-ducks are the product of certain trees, and he even represents these with the fruits which they bear. But by an unpardonable error for a naturalist, these pretended fruits from which the birds are issuing are only barnacles, crustaceans which live at the bottom of the sea, and with which he nevertheless overloads the miraculous boughs! After this one may well ask, which is the most censurable—the savant who transcribes such absurdities, or the public who believe in them?

Some plants have also become celebrated in the annals of charlatanism. There were plants that warded off evil, plants that caused injury, and magical plants. Antiquity possessed a long list of these, and we have not fallen behind it.

On one side we find a venerated plant, the St. John's-wort, which,



MARINE DRAGON: FROM MAGNUS.

gathered at the moment pointed out by the legend and hung over the outer door, preserved the house from lightning. On the other was a long list of cabalistic plants, among which the thorn-apple, ought to be mentioned in the first rank. This was the frightful poison which sorcerers made use of to intoxicate their senses.

But no magical herb ever enjoyed more celebrity than the mandrake, an indispensable ingredient in all the philtres employed by the old sorcerers. Antiquity had already conducted us to this dark road, by maintaining that the roots of this plant were of human form. To speak the truth, they in no way resemble a man, but the credulity of the learned and the astuteness of charlatanism have supplied what was requisite to give a certain amount of credulity to the opinions of the ancients. It was after they had rudely shaped themselves into human likeness that the magicians employed them in their incantations, and it was also under this form that the vulgar thought they were found at the foot of gibbets

where, after having fed on the remains of those who had suffered punishment, they had taken on their shape. The tenants of a place so sinister and so dreaded could not be removed without great danger. The learned themselves did not attempt to destroy so many absurdities, for in their works they sometimes represent mandrakes which resembled men and women, for there were some of both sexes. They possessed the same power as the enchanted philtres of Circe, to which Pliny and Dioscorides had given this name.

A charming little plant, all covered with hairs, which abounds on the slopes of Mount Ida, the dictamnus of Crete, was formerly considered

the most marvelous vulnerary that nature ever presented to man. The gods themselves had revealed its omnipotence to him, and animals instinctively made use of it. It was with this dictamnus that Venus dressed the wounds of Æneas. Aristotle tells us that the goats scattered over the celebrated mountain, so soon as the hunter has pierced them with an arrow, seek out the plant and eat it in



order to make the arrow THE BIRD-TREE: FAC-SIMILE FROM MUNSTER'S
 "COSMOGRAPHY."

drop out, and so to heal the wound. Half a century ago, who would have dared to deny such a wonderful property, when at that time a noble work on Greece contained a long chapter on the virtues of the divine vulnerary, and when, in addition to this, the reader might see an engraving representing a goat pierced with arrows and browsing upon the salutary herb? In this way, unfortunately, did the authority of the learned retard and fetter the progress of truth.

However simple the cause of eclipses may be, now that it is known—and known causes are always so simple, that one asks why they were never known before—however easy this explanation appears, for a long time the human race was astonished at the passing absence of the sun's light during the day; for a long time it felt full of fear and disquietude

before this unexplained wonder. The light of day was rapidly diminished, and suddenly disappeared without the sky being darkened by any cloud. Darkness instead of light, stars shining in the sky, nature seeming surprised and astonished; the combination of these unusual events is more than sufficient to explain the momentary terror with which individuals, and indeed, whole nations, allowed themselves to be carried away in these solemn moments.

By reason of the moon's rapid motion, a total eclipse never lasts longer than five minutes; but this short period is sufficient to allow a thousand sentiments to succeed each other in the terrified mind. The disappearance of the light of the moon, sometimes caused great trouble to ignorant minds; with how much more reason would the disappearance of the orb of day cause disquietude and fear!



TREE PRODUCING SEA-DUCKS.

History is full of the examples of fear caused by eclipses, and dangers caused through ignorance and superstition. Nicias had resolved to leave Sicily with his army; but, frightened by an eclipse of the moon, and wishing to delay several days, to assure himself if our satellite had lost nothing after this event, he missed the opportunity of retreat: his army was destroyed, he himself perished, and this misfortune commenced the ruin of Athens.

Often it has been seen that clever men have taken advantage of people's terror during eclipses, either of the sun or the moon, to gain their wishes. Christopher Columbus, reduced to sustaining his soldiers on the voluntary gifts of a savage and poor nation, and nearly losing this resource and perishing with hunger, gave out that he was about to deprive the world of the moon's light. The eclipse began, terror seized the Indians, and they returned, bringing to the feet of Columbus the accustomed tribute.

Drusus appeased a sedition in his army by predicting an eclipse of the moon; and, according to Livy, Tulpitius Gallus, in the war of Paulus Emilius against Perseus, used the same stratagem. Pericles, Agathocles,

king of Syracuse, and Dionysius, king of Sicily, nearly fell victims to the ignorance of their soldiers. Alexander, near Arbella, was obliged to use all his skill to calm the terror that an eclipse had cast over his troops. Thus it is that superior men, rather than sink under the circumstances which oppress them, exert their art to turn them to their profit.

How many fables were built on the idea that eclipses were the effect of Divine wrath, which avenged the iniquities of man by depriving him of light! Sometimes Diana sought Endymion in the mountains of Caria; sometimes the magicians of Thessaly caused the moon to fall on the herbs destined for enchantment.

Now it is a dragon which devours the sun, and whole nations seek to frighten it away by cries; or it is supposed that God holds the sun enclosed in a tube, and hides or shows us the light by means of a shutter.

The progress of science has proved the absurdity of these opinions and fears, since it is known to be possible to calculate by astronomical tables, and to predict a long time beforehand, the instant when the wrath of heaven will burst forth. Science is the sure death of superstition.



CARVED MANDRAGORA ROOTS.

Biot gives us very curious details on the rites which presided and which still preside over the observation of the eclipses in the Celestial Empire. The Emperor is considered to be the son of heaven; and with this title his government ought to present the picture of the immutable order which governs the celestial movements. When the two great luminaries—the sun and the moon—instead of following their own routes separately, cross each other's paths, the regularity of the order of the heavens appears to be upset; and the disturbance which is there manifested must have its likeness, as well as the cause, in the disorders of the government of the Emperor. An eclipse of the sun was then considered as a warning given by Heaven to the Emperor to examine his faults and correct them. When this phenomenon was announced beforehand by the appointed astronomer, the emperors and grandees of this court prepared themselves by fasting, and dressing in the plainest garments.

On this appointed day the mandarins attended at the palace with bows and arrows. When the eclipse commenced, the Emperor himself beat on the drum of thunder to give the alarm; and at the same time the mandarins let fly their arrows towards the sky to aid the eclipsed body. Gaubil quotes these particulars from the ancient Book of Rites, and the principals are announced in the Tcheou-li. After this, the discontent that would be caused by an eclipse not taking place at the time predicted may be imagined; and likewise if one suddenly appeared without being predicted. In the first case, the whole ceremonial was found to have been uselessly prepared; and the desperate efforts which, in consequence of the want of preparation, were made in the second case, inevitably produced a disorderly scene compromising to the imperial majesty. Such errors, although so easily made, placed the poor astronomers in danger of losing their goods, their office, their honor, and sometimes their life.

Such a disgrace happened in the year 721 of our era: the Emperor Hiouen-Tsong sent for a bonze Chinese, called Y-Hang, renowned for his knowledge of astronomy. After having shown himself very learned, he had the misfortune to predict two eclipses of the sun, which were ordered to be observed throughout the whole Empire. But no one saw anywhere on the appointed days any trace of an eclipse, although the sky was almost everywhere serene. To clear himself he published a work, in which he pretended that his calculation was exact, but that heaven had changed its rules of movement—doubtless in consideration of the high virtues of the Emperor. Thanks to his reputation, otherwise deserved—perhaps, also, to his flattery—he was pardoned.

The same ideas on the importance and signification of the moon and sun which existed with the Chinese more than four thousand years ago, remain at the present day, and are still powerful, causing the same demands; but they have become less perilous for astronomers, as these phenomena are now predicted several years in advance, with a mathematical certainty, in the great ephemerides of Europe and America, which can easily be procured.

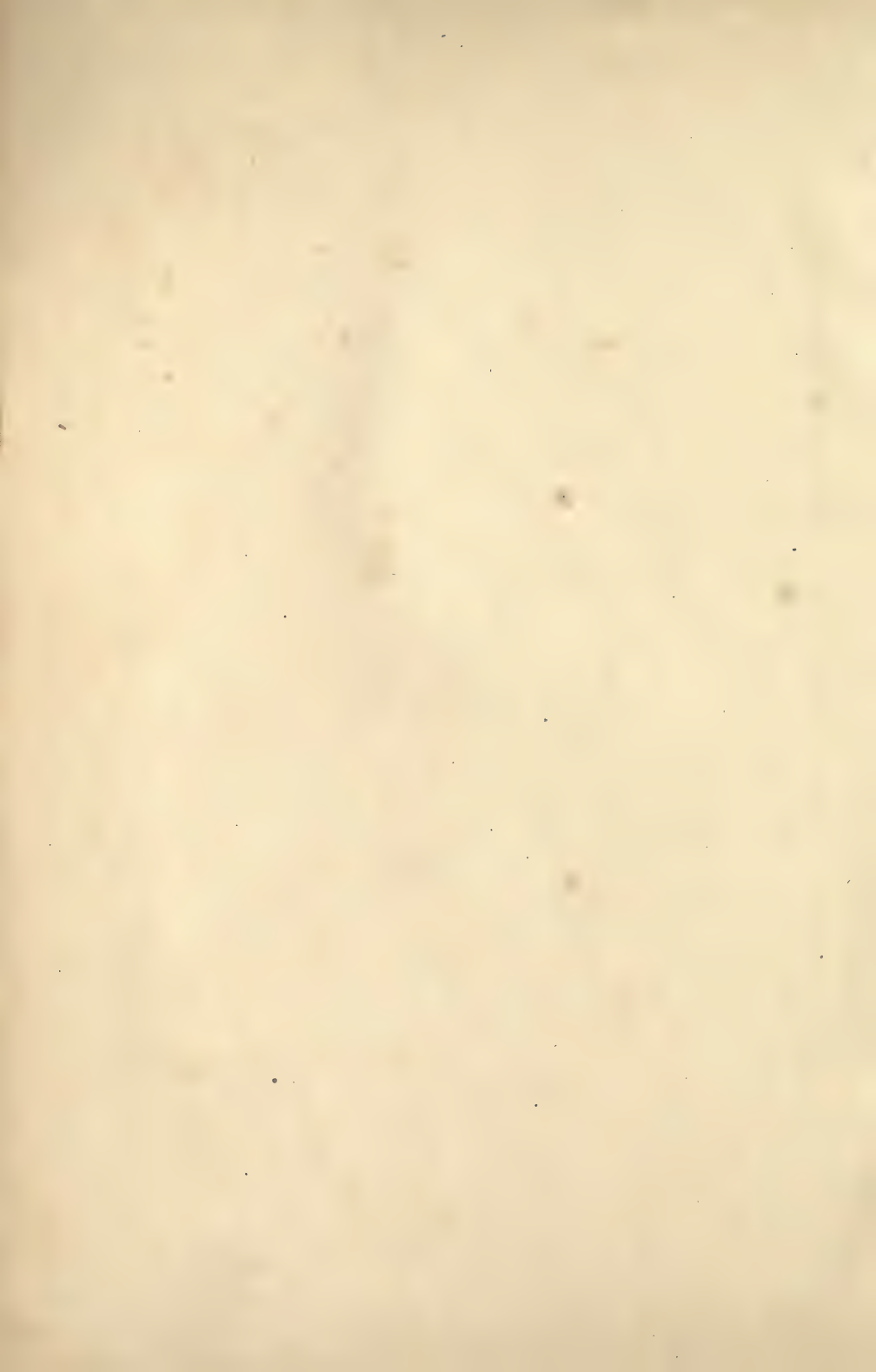


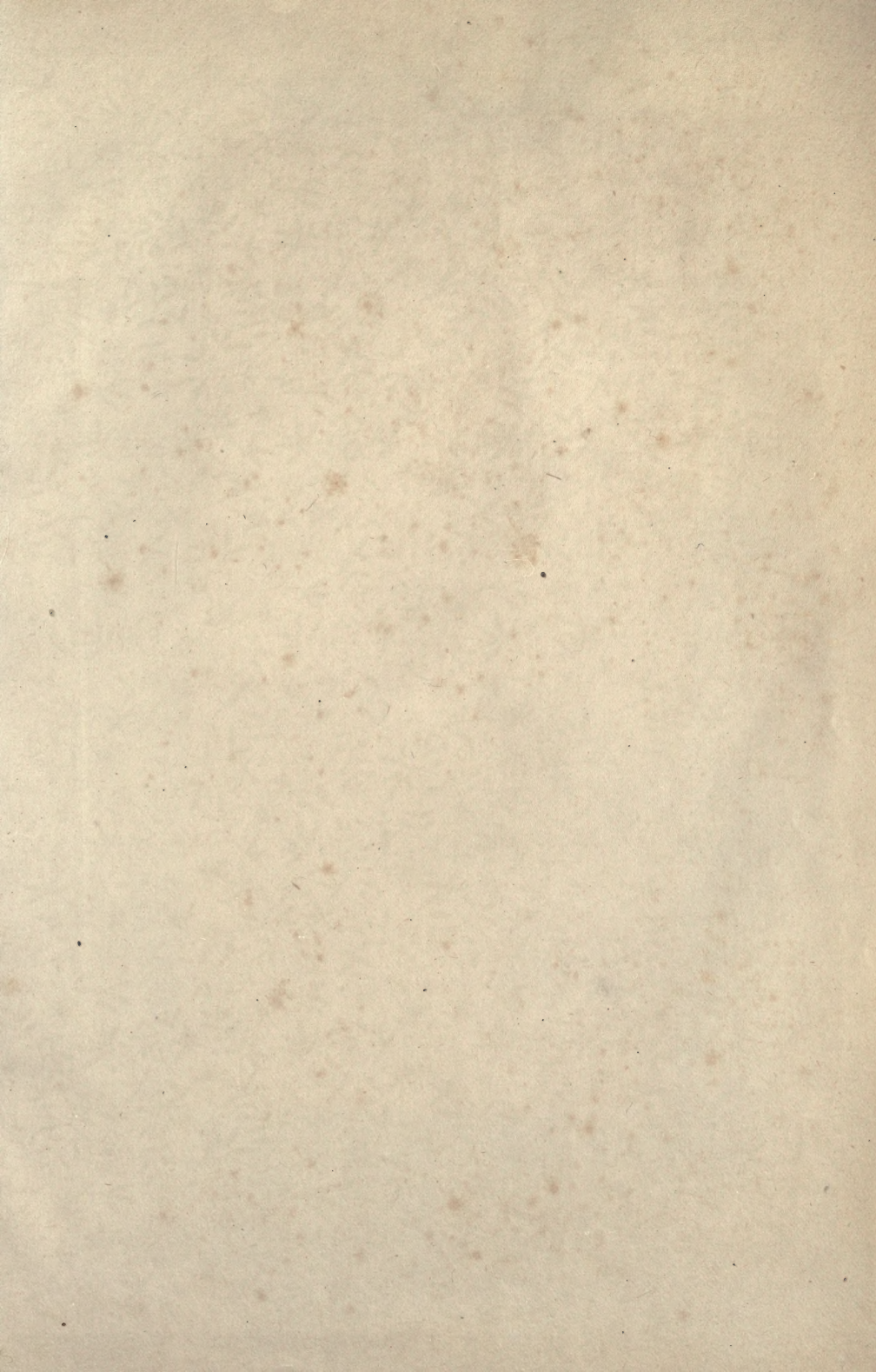
and the other, the first of which is the most important, is the fact that the library is not a mere collection of books, but a living organism, which grows and changes with the times. The second point is that the library is not a mere repository of knowledge, but a place where knowledge is used and shared. The third point is that the library is not a mere place of study, but a place where study is encouraged and supported. The fourth point is that the library is not a mere place of silence, but a place where the voices of the past and the present are heard. The fifth point is that the library is not a mere place of books, but a place where the books are used and shared. The sixth point is that the library is not a mere place of knowledge, but a place where knowledge is used and shared. The seventh point is that the library is not a mere place of study, but a place where study is encouraged and supported. The eighth point is that the library is not a mere place of silence, but a place where the voices of the past and the present are heard. The ninth point is that the library is not a mere place of books, but a place where the books are used and shared. The tenth point is that the library is not a mere place of knowledge, but a place where knowledge is used and shared.











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